

Friday December 14, 1990



Environmental Protection Agency

40 CFR Part 300 Hazard Ranking System; Final Rule



12-14-90 Vol. 55

No. 241

Friday December 14, 1990

Book 2

United States Government Printing Office puperintendent of DOCUMENTS Washington, DC 20402

OFFICIAL BUSINESS Penalty for private use, \$300

SECOND CLASS NEWSPAPER

Postage and Fees Paid U.S. Government Printing Office (ISSN 0097-6326)

ENVIRONMENTAL PROTECTION AGENCY

49 CFR Part 300

(FBL-3739-6)

Red 2050 4873

Hestard Ranking System

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

summary: The Buviroumental Protection Agency (EPA) is adopting revisions to the Hazard Ranking System (HRS), the principal mechanism for placing sites on the National Priorities List (NPL). The sevisions change the way EPA evaluates potential threats to human health and the environment from hezardous waste sites and make the HRS more accurate in assessing relative potential risk. ne sevisions comply with other story sequirements in the Superfund These revis s and Resultorization Act of HOS BARAL

BATTER Effective date Merch 14, 1991. As discussed in Section III H of this preamble, comments are invited on the addition of specific benchmarks in the air and sell exposure pathways until James y 14, 1881.

mic Documents related to this relemaking are available at and comments on the specific beachmarks in the air and soil exposure pathways may be smalled to the CERCLA Docket Office, OS-365, U.S. Environmental Protection Agency, Waterside Mail, 401 M Street. SW, Washington, DC 20000, phone 202-302-3005. Please sand four copies of ents. The docket is available for viewing by appointment only from 2:00 am to 4:00 pm. Monday through Friday, excluding Pederal helidays. The docket ber is MSNCP-HRS.

POR PURINGER RECOMMATION CONTACT: Steve Caldwell or Agnes Ortiz, Hezardous Site Bralantion Division. Office of Emergency and Remedial Response, OS-230, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20000, or the Superfund Hotline at 800-121-6346 (in the Washington, DC area, 283-382-3000, SUPPLEMENTARY INFORMATION

Table of Cont

- L Background
- I. Overview of the Final Rule
- III. Discussion of Comments
 A. Simplification
- B. HRS Structure le
- C. Hazardous Waste Qua
- D. Tenicity
- F. Mobility/Persistence

- G. Observed Rele e H. Benchmarks
- L Use Pactors
- J. Sensitive Environments K. Use of Available Data
- L. Ground Water Migration Pathway M. Surface Water Migration Pathway
- N. Soil Exposure Pathway O. Air Migration Pathway

- P. Large Volume Wastes
 Q. Consideration of Removal Actions (Current Versus Initial Conditions)
- R. Cutoff Scere
- IV. Section-by-Section Applysis of the Bult

- Changes
 V. Required Analyses
 A. Buscative Order No. 12291
 B. Regulatory Plexibility Analysis
 C. Paperwork Reduction Act
- D. Federalism Implications

I. Beckmound

In 1980, Congress enacted the Contrebensive Environmental Response, Compensation, and Liability Act [CERCLA] (42 U.S.C. 9801 et seq.], commonly called the Superfund, in response to the dangers posed by controlled releases of hazardous substances, contaminants, and polintants. To implement section 195(8)(A) of CERCLA and Executive Order 12316 (46 FR 42237, August 20, 1981), the U.S. Environmental Protection Agency (EPA) revised the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR part 300, on July 16, 1962 (47 FR 31180), with later revisions on September 18, 1985 (50 FR 37624), November 20, 1985 (50 FR 67912), and March 8, 1990 (55 FR 8886). The NCP sets forth guidelines and procedures for responding to releases or potential release of hazardous substances, pollutants, or contaminants.

Section 105(8)(A) of CERCLA (now section 105(a)(8)(A)) requires EPA to ectablish-

Criteria for determining priorities emeng releases or threatened releases (of hexardens substances) throughout the United States for the purpose of taking remedial action and, to the extent practicable taking into account the potential urgency of such action, for the epose of taking removal action. Criteria al sciorities * * * shall be based upon the and priorities ' relative risk or danger to public health or welfare or the environment " taking into account to the extent possible the populati at risk, the hazard potential of the hazards substances at such facilities, the potential for nation of drinking water supplies, the potential for direct human contact, [and] the potential for destruction of sensitive ecosystems '

To meet this requirement and help set priorities, EPA adopted the Hazard Ranking System (HRS) as appendix A to the NCP [47 FR 31180, July 16, 1982]. The HRS is a scoring system used to assess the relative threat associated with actual or potential releases of hazardous

substances at sites. The HRS is the primary way of determining whether a site is to be included on the National Priorities List (NPL), the Agency's list of sites that are priorities for long-term evaluation and remedial response, and is a crucial part of the Agency's program to address the identification of actual and potential releases. (Each State can ate one site to the NPL as a State top priority regardless of its HRS score: sites may also be added in response to a health advisory from the Agency for Toxic Substances and Disease Registry (see NCP, 40 CPR 300.425(c)(3)).) Under the original HRS, a score was determined for a site by evaluating three gration pathways—ground water. surface water, and air. Direct contact and fire and explosion threats were also evaluated to determine the need for emergency actions, but did not enter into the decision on whether to place a site on the NFL

In 1986, Congress enacted the Superfund Amendments and Reauthorization Act of 1986 (SARA) (Pub. L. 99–499), which added section 105(c)(1) to CERCLA, requiring EPA to nd the HRS to assure "to the maximum extent feasible, that the hazard ranking system accurately assesses the relative degree of risk to on heelth and the environment posed by sites and facilities subject to review." Congress, in its Conference Report on SARA, stated the substantive standard against which HRS revisions could be assessed:

This standard is to be applied within the context of the purpose for the National Priorities List; i.e., identifying for the States and the public those facilities and sites which cur to waterest remedial actions. appear to waterms removed water, require the This standard does not, however, require the Manada Pankino Stratem to be equivalent to Hazard Ranking System to be equivalent to described risk assessments, quantitative or detailed risk accomments, quantitative or qualitative, such as might be performed as part of remodial actions. The standard nives the Hazard Ranking System to rank sites as accurately as the A feasible using information f ncy believes is rantice from preliminary assessments and site inspections

Meeting this standard does not require long-term menitoring or an accurate determination of the full nature and extent of contamination at aites or the projected levels of exposure such as might be done during remedial investigations and feasibility studies. This revision is intended to ensure that the exact Ranking System performs with a degree of accuracy appropriate to its role in expeditionally identifying candidates for itiously identifying condidates for use actions. [FLR. Rep. No. 962, 991. Cong., 2nd Sess. at 199-300 [1986]]

Section 105(c)[2] further specifies that the HRS appropriately assess the human health risks associated with actual or potential contamination of surface waters used for recreation or drinking

water and that this assessment should take into account the potential migration of any hazardous substance through surface water to downstream sources of drinking water.

SARA added two criteria for evaluating sites under section 105(a)(8)(A): Actual or potential contamination of the ambient air and threats through the human food chain: In addition, CERCLA section 118, added by SARA, requires EPA to give a high priority to facilities where the release of hazardous substances has resulted in the closing of drinking water wells or has contaminated a principal drinking water supply. Finally, CERCLA section 125, added by SARA, requires revisions to the HRS to address facilities that contain substantial volumes of wastes specified in section 3001(b)(3)(A)(i) of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act (RCRA). These wastes include fly ash wastes, bottom ash wastes, slag wastes. and flue gas emission control wastes generated primarily from the combustion of coal or other fossil fuels. Specifically, section 125 requires EPA to revise the HRS to assure the appropriate consideration of each of the following site-specific characteristics of such facilities:

- The quantity, toxicity, and concentrations of hazardous constituents that are present in such waste and a comparison with other wastes:
- The extent of, and potential for, release of such hazardous constituents into the environment; and
- The degree of risk to human health and the environment posed by such constituents.

EPA published an advance notice of proposed rulemaking (ANPRM) on April 9, 1987 (52 FR 11513), announcing its intention to revise the HRS and requesting comments on a number of issues. After a comprehensive review of the original HRS, including consideration of alternative models and Science Advisory Board review, EPA published a notice of proposed rulemaking (NPRM) for HRS revisions on December 23, 1988 (53 FR 51982). The NPRM contains a detailed preamble, which should be consulted for a more extensive discussion of CERCLA, SARA. the HRS, and the proposed changes to the HRS.

Today. EPA is publishing the revised HRS, which will supersede the HRS previously in effect as appendix A to the NCP. CERCLA section 105(c)(1) states that the revised HRS shall be applied to any site newly listed on the NPL after its effective date; as specified in section

105(c)(3), sites scored with the original HRS prior to that effective date need not be reevaluated.

The HRS is a scoring system based on factors grouped into three factor categories. The factor categories are multiplied and then normalized to 100 points to obtain a pathway score (e.g., the ground water migration pathway score). The final HRS score is obtained by combining the pathway scores using a root-mean-square method. The proposed HRS revised every factor to some extent. A few factors were replaced, and several new factors were added. The major proposed changes included:

- (1) Consideration of potential as well as actual releases to air;
- (2) Addition of mobility factors; (3) Addition of dilution and distance weightings for the water migration pathways and modification of distance weighting in the air migration pathway;
- (4) Revisions to the toxicity factor.
- (5) Additions to the list of covered sensitive environments;
- (6) Addition of human food chain and recreation threats to the surface water migration pathway;
- (7) Revision of the hazardous waste quantity factor to allow a tiered approach;
- (8) Addition of health-based benchmarks for evaluating population factors and ecological-based benchmarks for evaluating sensitive environments;
- (9) Addition of factors for evaluating the maximally exposed individual; and (10) Inclusion of a new onsite
- exposure pathway.

EPA conducted a field test of the proposed HRS to assess the feasibility of implementing the proposed HRS factors, to determine resources required for specific tasks, to assess the availability of information needed for evaluation of sites, and to identify difficulties with the use of the proposed revisions. To meet the objectives, site inspections were performed at 29 sites nationwide. The sites were selected either because work was already planned at the site or because the sites had specific features EPA wanted to test using the proposed revisions to the HRS. The major results of the field test were summarized on September 14, 1989 (54 FR 37949), when the field test report was made available for public review and comment.

II. Overview of the Final Rule

The rule being promulgated today incorporates substantial changes to revisions proposed in December 1986. EPA has changed the rule for three reasons: {1} To respond to the general

comment submitted by many commenters that the factor categories and pathways need to be consistent with each other; (2) to respond to specific recommendations made by commenters; and (3) to respond to problems identified during the field test and discussed in the field test report. Major changes affecting multiple pathways include:

- Multiplication of hazardous waste quantity factor, toxicity, and other waste characteristics factors;
- Uncapping of population factors (i.e., no limit is placed on maximum value);
- Revised criteria for establishing an observed release;
- Capping of potential to release at a value less than observed release;
- Revision of the toxicity evaluation to select carcinogenic and non-cancer chronic values in preference to acute toxicity values;
- Elimination of Level III concentrations and extension of weighting based on levels of exposure to nearest individual (well/intake; formerly maximally exposed individual) factors;
- Modification of the weights assigned to Level I and Level II concentrations:
- Revisions to the benchmarks used and methods for determining exceedance of benchmarks;
- Use of ranges to assign values for potentially exposed populations;
- Inclusion of factors assessing exposures of the nearest individual in all pathways;
- Revisions to distance and dilution weights in all pathways except ground water migration;
- Replacement of the use factors with less heavily weighted resources factors;
- Evaluation of wetlands based on size or surface water frontage; and
- Specific instructions for the evaluation of radionuclides at radioactive waste sites and sites with radioactive and other hazardous substances wastes.

The major changes in the ground water migration pathway include:

- Replacement of depth to aquifer/ hydraulic conductivity and sorptive capacity factors with travel time and depth to aquifer factors; and
- Revision of the mobility factor, including consideration of distribution coefficients.

In the surface water migration pathways, the major changes include:

- Elimination of the separate recreational use threat:
- Addition of a ground water to surface water component;

- Incorporation of bioaccumulation into the weste characteristics factor agery rather then the targets factor agory for the human food chain tot:
- Revision to allow use of additional tissus samples in establishing Level I concentrations for the human food chain threat and
- Addition of ecosystem bioeccumulation potential factor for sensitive environments.
- The major charges in the soil exposure pathway (formerly the onsite exposure pathway) include:
- Elimination of separate consideration of the high risk. population;
- Inclusion of hazardous waste sentity in the waste characteristics factor category;
- · Consideration of workers in the resident threat's targets factor category;
- · Revisions to scoring of terrestrial nellive environments.
- The major changes in the air
- igration pathway include:

 Separate evaluation of gas and articulate potential to release; and

 Consideration of actual
- contamination in evaluating sensitive
- Pigures 1 to 4 show the differences between the pathways in the original HBS and in the final rule.

COLUMN COSTS COMP-00-40

Figure 1

Ground Water Migration Pathway

ORIGINAL HRS

Waste Characteristics X	Targets
Toxicity/Persistence Hazardous Waste Quantity	Ground Water Use Distance to Nearest Well/
	Population Served
	· · · · •
·	
	· .
•	

FINAL HRS

Likelihood of Release X	Waste Characteristics X	Targets
Observed Release or Potential to Release Containment Net Precipitation	Toxicity/Mobility Hazardous Waste Quantity	Nearest Well Population Resources Wellhead Protection Area
Depth to Aquifer Travel Time		

Figure 2

Surface Water Migration Pathway

ORIGINAL HRS

Likelihood of Release Observed Release

00

Route Characteristics

Facility Slope/Intervening

X

Terrain

1-Year, 24-Hour Rainfall

Distance to Nearest Surface

Water

Physical State

Containment

Waste Characteristics
Toxicity/Persistence

Hazardous Waste Quantity

Targets

X

Surface Water Use

Distance to Sensitive Environment Population Served/Distance to

Nearest Intake Downstream

Surface Water Migration Pathway (continued)

FINAL HRS Likelihood of Release: Overland Flow/Flood Component

Observed Release

Potential to Release

By Overland Flow

Containment

Runoff

Distance to Surface

Water

By Flood

Containment Flood Frequency

OF

Likelihood of Release: Ground Water to Surface Water Component

Observed Release

or

Potential to Release

Containment

Net Precipitation

Depth to Aquifer

Travel Time

Drinking Water Threat

Waste Characteristics

Toxicity/Mobility 1/Persistence

Hazardous Waste Quantity

Targets

Nearest Intake

Population Resources

Human Food Chain Threat

Waste Characteristics

Toxicity/Mobility 1/

Targets

Food Chain Individual Persistence/Bioaccumulation

Hazardous Waste Quantity

Population

Environmental Threat

Waste Characteristics

Targets

Ecosystem Tóxicity/Mobility 1/ Persistence/Bioaccumulation

Hazardous Waste Quantity

Sensitive Environments

Mobility is only applicable to the Ground Water to Surface Water Component.

Figure 3

Soil Exposure Pathway¹

FINAL HRS

Resident Population Threat

Likelihood of Exposure	X	Waste Characteristics	X	Targets
Objected Contamination		Toxicity Hazardous Wasse Quantity		Resident Individual Resident Population Workers Resources Terrestrial Sensitive Environments

Nearby Population Threat

Likelihood of Exposure	X	Waste Characteristics	X	Targets
Attractiveness/Accessibility Area of Contamination		Toxicity Hazardous Waste Quantity		Population Within 1 Mile Nearby Individual

New pathway.

Figure 4

Air Migration Pathway

ORIGINAL HRS

Likelihood of Release	X	Waste Characteristics X	Targets
Observed Release	•	Reactivity and Incompatibility Toxicity Hazardous Waste Quantity	Population Within 4-Mile Radius Distance to Sensitive Environment Land Use

FINAL HRS

Likelihood of Release	X	Waste Characteristics	X	Targets
Observed Release		Toxicity/Mobility Hazardous Waste Quantity		Nearest Individual Population
Potential to Release				Resources Sensitive Environments
Gas .				
Gas Containment				•
Gas Source Type				
Gas Migration Poten	itial			
Particulate		·		•
Particulate Containn	nent			·
Particulate Source T				
Particulate Migration				.
Potential		>		

BILLING CODE 6569-56-C

Section III of this preemble summerizes and sesponds to unjor investigates and sesponds to unjor investigates and sesponds to unjor investigates and sesponds of the investigates of individual pathway investigates of individual pathway investigates. Section IV provides a section-by-section discussion of the final rule. All substantive changes not discussed in section III are identified in section IV. Decrease the rule has been substantially rewritten to clarify the requirements, editorial changes are not generally noted.

M. Discussion of Community

About 100 groups and individuals submitted comments on the ANPRM and NPRM. Nineteen of these also submitted comments on the field test report; two other groups submitted comments only on the field test report. The comments only on the field test report. The comments included more than 20 State agencies, several Pederal agencies, companies, trade associations, Indian tribes, servicesmental groups, technical committents, and individuals. This section summerizes and responds to the mojor issues raised by comments and EPA's response to each issue raised in the comments are available in Responses to Comments on Revisions to the Hozord Ronking System (HRS) in the EPA CRECLA docket (see ADDRESSES section above).

A. Simplification

In response to SARA, EPA proposed revisions to the HRS so that, to the maximum extent feasible, it accurately assesses the relative risks posed by hazardous waste sites to human health and the envisousent. Cousequently, the proposed rule required more data than did the cristal HRS.

did the original HRS.
A number of commenters stated that the data collection requirements of the proposed rule were excessive given its purpose as a screening tool. These enters expressed concern that the data requirements were too extensive for a screening process; specifically, that nents would lengthen the data req the time needed to score sites with the HRS, increase the cost of listing sites. and, therefore, limit the money available for remedial actions. Most even those who considered that the revisions increased the accuracy of the model—stated that the resources required to evaluate sites under the proposed HRS were excessive.

One commenter suggested the proposed HRS would be so expensive to implement that EPA would need to develop a new screening tool to determine whether a site should undergo

an HRS evaluatic . Another commenter suggested that because of the complexity of the proposed revisions ninary scoring of a site during the sile acces ment process would be tractical because sites would advance too far in the site assessment process before they were determined not to be NPL candidates. Several neaters stated that, with the additional requirements, the proper HRS is more of a quantitative risk-assessment tool than the screening ng tool it is supposed to be. Another su that the increased accuracy of the proposed rule over the original HRS is of narginal value relative to the amount of e and money involved, and that the HRS is no longer a quick and inexpensive method of assess relative risks associated with sites.

Several commenters expressed concern that the increased data requirements of the proposed HRS would affect the schedule of the entire site assessment process. They suggested that these requirements would create a backleg of sites to be evaluated, slow the process of listing sites, and delay cleanup. Some noted that this would be contrary to the goal of identifying and evaluating sites expeditiously.

in response, the Agency believes the requirements of the final rule are within the scope of the site assessment process and that a new acreening tool to determine whether a site should undergo an HRS evaluation will not be needed. To assist in acroening sites, the site assessment process is divided into two stages:

 A preliminary assessment (PA), which focuses on a visual inspection, collection of available local, State, and Federal permitting data, site-specific information (e.g., topography, population), and historical industrial activity; and

 A site inspection (SI), where PA data are augmented by additional data collection, including sampling of appropriate environmental media and wastes, to determine the likelihood of a site receiving a high enough HRS score to be considered for the NPL.

The field test identified a best estimate of the average and range of costs incurred to support the data requirements of the proposed HRS. These cost estimates represented the entire site assessment process from PA to SI, and comprehensive evaluations for all pathways at most sites. As such, the Agency believes these cost estimates overstate the costs associated with site assessments occurring on the greater universe of CERCLA sites. The amount of data collected during an SI varies from site to site depending on the

complexity of the site and the number of environmental media believed to be contaminated. Some Sis may be limited in scope if data are easy to obtain, while others sequine more substantial resource commitments. The most important factors in determining costliness of an SI are (1) the passence or absence of ground water monitoring wells in situations where ground water is affected, and (2) the number of affected madia, which determines the number of samples taken and analyzed. The Agency believes the greater universe of CERCLA sites will not require the more substantial resource commitments.

Pinally, EPA does not agree that the requirements of the final rule will delay the listing of siles. The site assessment process screens sites at each stage, thereby limiting the number of sites that require evaluation for scening. The Agency believes that it will be possible to score sites expeditiously with the revised HRS.

The Agency believes the additional data requirements of the final rule will make it more accurately reflect the relative risks posed by sites, but also that the HRS should be as simple as possible to make it ensier to implement and to retain its usefulness as a accusing device. This approach responds to the majority of commenters who recommended that IPA simplify the proposed HRS to make it easier and less expensive to implement. In response to these comments, the rule adopted today includes a number of changes from the proposed rule that simplify the HRS. These simplifying changes were based largely on EPA's field test of the proposed rule, sensitivity studies, and issue analyses undertain.

- In the surface water migration pathway, the proposed recreation threat has been eliminated as a separate threat. Instead of requiring a separate set of detailed calculations and data, the final rule accounts for recreational use exposures through resources factors, where points may be added for recreation use.
- " In the ground water migration pathway, the proposed potential to release has been simplified by dropping "surptive capacity," by revising "depth to squifer" and making it a separate factor, and by eliminating the requirement to consider all geological layers between the hezardous substance and the aquifer in evaluating travel time to the aquifer. The "travel time" factor (the depth to aquifer/hydraulic conductivity factor in the proposed rule)

is now based on the layer(s) with the lowest hydraulic conductivity.

In the three migration pathways (i.e., ground water, surface water, and air), the use factors in the proposed rule—"land use" in the air migration pathway, "thinking water use" and "other water use" in the ground water migration pathway, and "drinking water use" and "other water use" in the surface water migration pathway—have been replaced by "resources" factors. The "fishery use" factor has been dropped from the surface water migration pathway. A resources factor has been added to the soil exposure

pathway.

• In the soil exposure pathway, the requirement that children under seven be counted as a separate population has been dropped. The "accessibility/frequency of use" factor has been replaced by a simpler "attractiveness/

accessibility" factor.

• In the surface water migration pathway, the "runoff curve number." which required determining the predominant land use within the drainage area, has been replaced by a simpler factor, "soil group," which only requires classifying the predominant soil group in the drainage area into one of four categories.

 In the air migration pathway, the maps used to assign values of particulate migration potential (formerly particulate mobility under potential to release) have been simplified.

 In all pathways, potentially exposed populations are assigned values based on ranges rather than exact counts, reducing documentation requirements.
 In the surface water and ground

 In the surface water and ground water migration pathways, Level III benchmarks have been dropped.

• In all pathways, hazardous waste quantity values are based on ranges, which will reduce documentation requirements. The methodology and explanation for evaluating the hazardous waste quantity factor have been simplified.

 Containment tables have been simplified in the air, ground water, and surface water migration pathways.

A number of the simplifications, such as the changes to the travel time and hazardous waste quantity factors, better reflect the uncertainty of the underlying site data and, therefore, do not generally affect the accuracy of the HRS. In addition, EPA notes that some revisions that may appear to make the HRS more complex actually make it more flexible. For example, the hierarchy for determining hazardous waste quantity allows using data on the quantity of hazardous constituents if they are available or can be determined;

additionally, data on the quantity of hazardous wastestreams, source volume, and source area can be used, depending on the completeness of data within the hierarchy. The hierarchy allows a site to be scored at the most precise level for which data are reasonably available, but does not require extensive data collection where available data are less precise.

In response to comments on the complexity of the rule language, the presentation of the HRS has been reorganized and clarified. Factors that are evaluated in more than one pathway are explained in a separate section of the final rule (§ 2) to eliminate the repetition of instructions. The proposed HRS included descriptive background material that, while useful, made the HRS difficult to read. Much of this descriptive material has been removed from the rule.

B. HRS Structure Issues

Although the proposed rule retained the basic structure of the original HRS, a number of commenters felt that the HRS should provide results consistent with the results of a quantitative risk assessment. Several commenters identified this issue explicitly, while others identified specific aspects of the proposed rule that they believed to be inconsistent with basic risk assessment principles. The commenters maintained that if the HRS is to reflect relative risks to the extent feasible, as required by the statute, its structure should be modified to better reflect the methods employed in quantitative risk assessments. Commenters stressed the need for EPA to follow the advice of the EPA Science Advisory Board (SAB) as expressed in the SAB review of the HRS:

Revisions to the FRS should begin with the development of a chain of logic, without regard for the ease or difficulty of collecting data, that would lead to a risk assessment for each site. This framework, but not the underlying logic, would be simplified to account for the very real difficulties of data collection.

This chain of logic * * * should lead to a situation in which an increased score reflects an increased risk presented by a site.

In response to the structural issues raised by commenters and to the statutory mandate to reflect relative risk to the extent feasible, EPA made a number of changes to the final rule. These structural changes affect how various factors are scored and how scores are combined, but do not involve changes in the types or amount of data required to score a site with the HRS. The Agency stresses that the limited data generated at the SI stage are designed to support site screening, and

are not intended to provide support for a quantitative risk assessment.

General structural changes. While the final rule retains the basic structure of the proposed rule in that three factor categories (likelihood of release, waste characteristics, and targets) continue to be multiplied together to obtain pathway scores, the structure has been changed in certain respects to make the underlying logic of the HRS more consistent with risk assessment principles.

The key structural changes to the waste characteristics factor category were to-make use of consistent scales and to multiply the hazardous waste quantity and toxicity (or, depending on the pathway and threat, toxicity/ mobility, toxicity/persistence, or toxicity/persistence/biosccumulation) factors. Within the waste characteristics factor category, factors have been modified so they are on linear scales. These modifications make the functional relationships between the HRS factors more consistent with the toxicity and exposure parameters evaluated in risk assessments.

Where possible, the final rule assigns similar maximum point values to factor categories across pathways. The likelihood of release (likelihood of exposure) factor category is assigned a maximum value of 550; the waste characteristics factor category is assigned a maximum value of 100 (except for the human food chain and environmental threats of the surface water migration pathway); the targets factor category is not assigned a maximum. EPA determined that in general targets should be a key determinant of site threat because the data on which the targets factors are based are relatively more reliable than most other data available at the SI

Likelihood of release. Except in the air migration pathway, the proposed rule assigned the same maximum value to observed release and potential to release. in the final rule, an observed release is assigned a value of 550 points and potential to release has a maximum value of 500 in all pathways. This relative weighting of values reflects the greater confidence (the association of risks with targets) when reporting an observed release as opposed to a potential release. As a result of this change in point values at the factor category level; as well as the new maximums for most pathways, the values assigned to individual potential to release factors have been adjusted.

Waste characteristics. The proposed rule assigned a maximum point value to

hazardous substance cuantities of 1,000 pounds. Because some altes have hazardous substance quantities for in excess of that amount and because it is reasonable to assume that these sites present some additional risk, all else being equal, the final rule elevates the maximum value to quantities in excess of 1,000,000 pounds. Even when hazardous waste quantity is documented with precision, EPA concluded that these are diminishing returns in considering quantities above this amount.

Although the IRS does not employ the same type and quality of information that would be used to support a risk assessment (e.g., panels of weste and sobility are combined in the ground water pathway as a surrogate for long-term magnitude of salesans), as waste characteristics values rise, contemination resulting from conditions at the alter in general should be worse. As a negative in general should be worse. As a negative in general should be worse, as a negative in general should be worse characteristics factors, the influence of the waste characteristics factors, the influence of the waste characteristics factor category could be dispreparationately large solutive to the likelihood of release and targets factor categories in determining everall pathway scarse. Therefore, EPA is limiting—descept use of a scale transformation—the values assigned to the veste characteristics factor category, shown in Table 2–7 of the final HRS, to limit the effect of weste characteristics on the pathway scores.

While the weste characteristics factor values are limited to values of 0 to 100 in most cases, the waste characteristics factor entagery may reach values of up to 1,000 for both the human food choin and cavingmental threats in the surface water migration pathway. These exceptions have been made to accommodate the bioaccommistion factor (or acceptants bioaccommistion factor), applied in these threats but not in other pathways or threats, which can add up to four erders of magnitude to the waste characteristics factor values before reduction to the scale values of 0 to 1,000.

Targets. The final rule includes two major structural changes to the targets factor category. Population factor values are not capped as they were in the projected rule. This change allows a site with a large population but a low waste characteristics value to receive scores similar to a site with a smaller population but larger waste characteristics value (as would be done in a risk assessment). A second change in the targets factors involves the

nearest individual (or intake or well) factors (i.e., the maximally exposed individual factors in the proposed rule). These factors are now assigned values based on exposure to Level I and Level II contentantion (50 and 45 points, respectively). Potentially exposed asserts individuals are assigned a maximum of 20 points in all values for these factors to give more relative weight to individuals that are exposed to documented contamination.

C. Hanardous Waste Quantity

In the NPRM. EPA proposed to change the heautdoos waste quantity factor to allow the use of four levels of data depending on what data are available and how complete they are. Hazardous waste quantity for a source could be based on (a) hazardous constituent quantity, (b) the total quantity of hazardous wastes in the source, (c) the volume of the source, or (d) the area of the source. Each source at the site would be evaluated separately, based on data available for the source.

EPA received numerous comments relating to changes in the hazardous waste quantity factor. Several commenters agreed that allowing use of waste constituent data, when available, was an improvement over the original HRS. Several also supported the tiened approach to acceing hexardous waste quantity when constituent data were incomplete or unevallable.

complete or unevallable.
Two commenters stated that the hasis on hazardous constituent data will require more extensive and quire more uncommon. These sive site investigations. These menters have mis sevisions. The rule does not require the scorer to determine bezardous enstituent quantities in all instr but simply encourages use of those data when they are available. This approach allows a scorer the flexibility to a sent types of available data for scoring hazardous waste quantity. At a ms, the source need only determine the area of a source (or the area of observed contamination), which is routinely done in site inspections. Where better data are available, they may be used in scoring the factor. This approach is in keeping with the intent of Congress that the HRS should act as a screening tool for identifying sites restanting further investigation.

Several communiers stated that the methodology for determining hazardous waste quantity was too complex and time consuming, and that its administrative costs outweighed its benefits. Others found the proposed rule instructions and tables confusing and hard to follow.

EPA strongly disagnes with the claim that the costs of the revised approach to scening waste quantity outweigh its benefits. The amount of hezardous substances passent at a site is an important indicates of the potential theat the site poses. At the same time, EPA recognities that cost is an important consideration. In revising the hezardous waste quantity factor, however, the Agency believes it has established an appropriate believes it has established an appropriate believes fetween time and cost required for scening this factor and the degree of accuracy needed to evaluate the seletive risk of the site property.

In response to comments, area normalized the hexardous waste quantity scening methodology to make it easier to سَنَّهُ بِلِهِ ination of proposed rule Table 2-13, Hexardous Waste Quant Factor Brainstian Methodology and stity Werksheet. In addition, the scale for the hazardous wests quantity factor has been divided into ranges that span two orders of magnitude (100c) to reflect the transition whose quantities at typical sites. The practical effect of this scale ele (100c) to reflect the change is to reduce the data collection and documentation requirements. See §§ 243-2422. The final rule also clarifies the treatment of wastes classified as hazzedous under RCRA. Under CERCLA, any BCRA: hazardous waste stream is considered a hazardous substance. If this definition were strictly applied in evaluating basardous waste ntity of BCRA hexardous name, hazardone constituent illy and henerious wastestreen sity would be the same because the entire wastestream would be considered a hexardres substance. The final rule s clear that only the constitues makes clear that easy me conscious as a RCRA westestesses that are CERCLA hazardess substances should be evaluated for determining hexardous constituent quantity, for the other three tiers, however, the entire RCRA wastestivem is considered as is any her westeste

As discussed in section III Q. EPA will consider removal actions when calculating waste quantities. EPA believes consideration of removal actions is likely to increase incentives for rapid actions. If there has been a removal at a site, and the hazardous constituent quantity for all sources and associated releases is adequately determined, the hazardous waste quantity factor value will be based only on the amount remaining after the removal. This will result in lowering some hazardous waste quantity factor values.

Where an adequate determination of the hazardous constituent quantity remaining after the removal cannot be made. RPA has established minimum hazardous waste quantity factor values in order to ensure that the HRS score reflects any continuing risks at the sites. In this case, the assigned hazardous waste quantity factor value will be the current hazardous waste quantity factor value (as derived in Table 2-6), or the minimum value, whichever is greater.

The proposed rule assigned a minimum hazardous waste quantity factor value of 10 when data on hazardous constituent quantity was not complete. In the final rule, for migration pathways (i.e., not the soil exposure pathway), if the hazardous constituent quantity is not adequately determined, and if any target is subject to Level I or Il contamination, the minimum hazardous waste quantity factor value

will be 100.

If the hazardous constituent quantity for all sources is not adequately determined, and none of the targets are subject to Level I or II contamination. the minimum factor value assigned for hazardous waste quantity depends on whether there has been a removal action, and what the hazardous waste quantity factor value would have been without consideration of the removal action. If there has not been a removal action, the minimum hazardous waste quantity factor value will be 10. If there has been a removal action and if a factor value of 100 or greater would have been assigned without consideration of the removal action, a minimum hazardous waste quantity factor value of 100 will be assigned. If the hazardous waste quantity factor value was less than 100 prior to consideration of the removal action. a minimum hazardous waste quantity factor value of 10 will be assigned. This will ensure that the Agency provides an incentive for removal actions and that in no case will consideration of removal actions result in an increased hazardous waste quantity factor value score.

D. Toxicity

The proposed HRS substantially changed the basis for evaluating toxicity. The major change was that hazardous substance toxicity would be based on carcinogenicity, chronic noncancer toxicity, and acute toxicity. For each migration pathway and each surface water threat except human food chain and recreation, toxicity was combined with mobility or persistence factors to select the hazardous substance with the highest combined value for toxicity and the applicable mobility or persistence factor. For the

kuman food chain threat, only substances with the highest bioaccumulation values were evaluated for toxicity/persistence. For the recreation threat, only substances with the highest dose adjusting factor values were evaluated for toxicity/persistence. In addition, ecosystem toxicity rather than human toxicity was evaluated for the environmental threat of the surface water migration pathway.

Several commenters expressed concern about or opposition to using the single most hazardous substance at a site to score toxicity, stating that the approach seems overly conservative and unlikely to distinguish sites on the basis of hazard. Some commenters suggested that EPA allow flexibility in weighting the toxicity values of multiple substances either by concentration. waste quantity, or proportion information, whenever such information is available. One commenter suggested basing toxicity on a fixed percentage of the hazardous substances known to be present at a site.

The Agency agrees that, for purposes of accurately assessing the risk to human health and the environment posed by a site, it would be preferable to evaluate the overall toxicity by considering all hazardous substances present, based on some type of dose- (or concentration-) weighted toxicity approach. EPA believes, however, that this approach is not feasible because the data requirements would be excessive. Such an approach would be feasible only when relative exposure levels of multiple substances are known or can reasonably be estimated; however, these data can be obtained only by conducting a comprehensive risk assessment. Extensive concentration data would be required to be confident that comparable concentrations are being used for the various substances, and that the multi-substance toxicity of the contaminants is not, in fact, being underestimated. Use of inadequate data could result in underestimating or overestimating the toxicity of substances in a pathway.

EPA considered a number of alternatives to the use of a single hazardous substance to score toxicity (mobility/persistence) and tested some of these on several real and hypothetical sites. The analyses included comparisons between the single most toxic substance and the average toxicity value for all substances, the average toxicity value for the 10 most toxic substances, and the concentrationweighted average value of all substances. These alternatives were also tested using toxicity/mobility

values. The results of these analyses showed that using a single substance approach usually resulted in an assigned value (either toxicity or toxicity/ mobility) that was within one interval in the scale of values of the alternatives tested; for example, the single substance approach would assign a value of 1,000 for toxicity whereas averaging the toxicities would assign a value of 1,000 or 100, the next lower scale value. (The final rule uses linear scales to assign values for toxicity, mobility, and persistence. The scales for toxicity now range from 0 to 10,000 rather than 0 to 5: consequently, the default value for toxicity is now 100 rather than 3.) The Agency recognizes the uncertainty in the use of the single substance approach, but concludes that it is a reasonable approach for a screening model, especially given the general unavailability of information to support alternatives. In making this judgment, the Agency notes that the single substance approach to evaluating the toxicity factor was not identified in SARA as a portion of the HRS requiring further examination, even though it had been used in the original HRS and EPA had received criticism similar to the above comments prior to the enactment of SARA.

Several commenters suggested that additive, synergistic, or antagonistic effects among substances be considered in scoring toxicity when several substances are found at a site. In particular, one commenter suggested increasing the scores for sites with a large number of hazardous substances to account for additive or synergistic effects.

As noted in EPA's 1988 Technical Support Document for the Proposed Revisions to the Hazard Ranking System, quantitative consideration of synergistic/antagonistic effects between hazardous substances is generally not possible even in RI/FS risk assessments because appropriate data are lacking for most combinations of substances. Interactive effects have been documented for only a few substance mixtures, and the Agency's risk assessment guidelines for mixtures (51 FR 34014, September 24, 1986) emphasize that although additivity is a theoretically sound concept, it is best applied for assessing mixtures of similar acting components that do not interact. Thus, the Agency believes that consideration of interactive effects in evaluating toxicity in the HRS is not feasible, nor is it necessary to allow use of the HRS as a screening model. The Agency rejects the suggestion that scores should simply be raised for sites

with numerous substances because this approach favores the technical complexities related to interactions (i.e., the possibility of antapoxistic effects.)

One commenter summer the comment of the comments o

One commenter suggested that a waste's testicity should be assessed in terms of its "diagree of risk," and that this could be measured by comparing constituent concentrations at the point of expanses to appropriate texticity reference levels. Two transmenters stated that testicity should be measured at a libely point of human exposure rather than at the waste site.

The testicity of a substance, as used in

the IIII, is an inhecest property, often extenses desergesparities as a goos ex some concentration associated with a specific response (i.e., a dose-response relationship). Those indicity values, in general, are independent of expected caviromental exposure levels; many are based on laboratory tests on male. Misk, on the other hand, is a action of texticity, the concentration of paper in assistantental media to . which humans may be exposed, and the Michigan of exposure to that medilin (and the population likely to be (and the population likely to be exposed). The testicity factor in the waste characteristics factor categor waste characteristics factor category of the HRS is intended to reflect only the inherest toxicity (i.e., the basic dose-response relationship) of substances found at the site. The HRS as a whole is atended to evaluate, to the extent able, relative risks peeed by sites by uding factors for likelihood of release, weste quantity, toxicity, and the precinity of potentially exposed populations. If actual contamination (for example, of deinking water) has been detected at a site, the measured environmental concentration of each rebetance is compared with its appropriate health-based or ecological-based concentration limit (i.e., its beachmerk). If these environmental concentrations equal or exceed a benchmark, certain target factors are med higher values then if stal concentrations are less den beschenerks.

Two commenters suggested using Cancer Potency Pactors to acore toxicity only for Class A and B1 carcinogens, and using seferance doses (RfDs) for scoring Class B2 and C carcinogens (i.e., substances for which there is inadequate or no direct human evidence of cascinogenicity).

In response, EPA believes that

In maponee. EPA believes that because the FRS is a screening tool, it should maintain a conservative (i.e., protective) approach to evaluation of potential cancer risks. EPA's 1995 Guidelines for Carcinogen Risk Assessment (SI PR 34014. September 24. 1989) provide for substances in Class A and Class B-(bo*k B1 and B2) to be regarded as sai...ble for quantitative-bases risk assessment. In general. according to EPA's 1900 Risk Assessment Gaidance for Superfund: Human Health Evolution Manual, Class G substances are evaluated for cancer risks assessment process. Thus, the use of cancer risk information for Class B2 and C substances in the FBCS is consistent with the objective of maintaining a conservative approach and with other Agency and Superfund program risk assessment guidelines.

In sesponse to commercial to score valiable data should be used to score variations by a second variations by a second variation of the second variations by a second variation of the second variations by a second variation of the second variation ents that the best sites, that accepted Agency practices be relied on, and that consistency across pathrays be encouraged, the Agency has modified slightly the way the toxicity value for a substance is dected. The final rule requires the use of carcinogenicity and chronic texticity data, when available, over acute toxicity data. If both slope factors and RfDs are available, the higher of the value med for these types of toxicity eters is used. If neither is evailable, but acute toxicity data are available, the acute toxicity data are used to seeign toxicity factor values. EPA decided to give preference to slope factors and RfD values because these undergo more extensive Agency review and are based on long-term exposure

E. Radiowachides

The proposed HES assigned radionacides a maximum toxicity value, but included no other procedures specific to radionacides.

One commanter, the U.S. Department of Energy (DOE), esserted that the proposed HPS ... contains an itable bies regarding redicamciides DOE specifically criticized assigning maximum toxicity factor values to radionaclides, " " wh where, in fact, the health impact associated with radionaclides is associated with the type of decay, the level of decay energy, the balf-life, the mobility, the concentration of the radiomaclide. internal biological factors, and external pathway factors." DOE proposed using concepts for evaluating radiosachides that were included in its Modified Hazard Ranking System (mHRS). In its subsequent comments on the HRS field test report. DOE stated that it considered the " ' method of handling radiousclides in the proposed revised HRS to be a serious flaw in the evaluation system.

in the final rule. EPA has clarified and significantly changed how radiomuclides are evaluated. Instead of using or adapting the milkS directly, however. EPA modified the proposed HRS to account more fully for radionuclides based on EPA's own methods for evaluating them, which are similar to and generally consistent with the radiation analysis concepts underlying the milkS.

The final rule evaluates radionuclides within the same basic structure as other hazardous substances, and the evaluation of many individual HRS factors is the same whether radious is we same wasses: radiouslides are present or not. Table 7-1 of the final rule lists HES factors and indicates which are evaluated differently for radionactides. Essentially, radiomechides are simply treated as additional hazardous substances with certain special characteristics that are accounted for by separate accoing rules for some HRS factors. For sites containing only radiousclides, the accoring process is very similar to the process at other hazardous substance sites, except that different according rules are applied to a number of substancespecific factors and a few other factors. For sites containing both radionaclides and other hazardous substances, both types of substances are scored for all HRS factors that are substance-specific, with everall factor values based either on combined values or the higher of the values, as appropriate.
EPA notes that, although some

radioactive substances are statutorily excluded from the definition of bazardous waste" in both CERCLA and RCRA (specifically, source, special nuclear, and bypandact nusterial as defined in the Atomic Energy Act of 1954), such substances may be, and generally are, "hexardous substance as defined in section 101(14) of CERCLA and therefore may be addressed under CERCLA. Radioactive substances should be included in HRS scoring and section 7 of the final rule is intended to facilitate that enalysis. It also should be and that two nazow categories of releases (either from "nuclear incidents" or from sites designated under the Uranium Mili Tailings Radiation Control Act of 1978) are excluded from CERCLA's definition of the term "release" (CERCIA section 101(22)), and such releases should not be scored using the HRS.

The major changes to the HRS in the evaluation of radiomeclides apply to establishing observed releases, to factors in the weste characteristics category, and to determining the level of actual contamination in the targets factor category. The HRS components that have been modified are briefly described below.

The criteria for establishing an observed release through analysis of samples for radionuclides differ considerably from the criteria used for other hazardous substances. These criteria are divided into three groups: radionuclides that occur naturally or are whiquitous in the environment; mammade radionuclides that are not ubiquitous in the environment; and gamma radiation (soil exposure pathway only). (See § 7.1.1.)

The hazardons waste quantity factor for sources (and areas of observed contamination) containing radionuclides has been modified to reflect the different units used to measure the amount of radiation (curies, a measure of activity) versus the units used for other hazardous substances (pounds, a measure of mass). EPA believes it is preferable to use activity units rather than mass units because activity is the standard measure of radiation quantity and is a better indicator of energy released and potential to cause human health damage than is mass. In addition, the hierarchy for evaluating the waste quantity factor for sources (and areas of observed contamination) containing radionuclides is limited to Tiers A and B. Tiers C and D, based on source volume and source area, respectively, are not used because adequate data to derive their quantitative relationship to Tier A were unavailable. Thus, the waste quantity factor is based either on radionuclide constituent quantity (Tier A) or radionuclide wastestream quantity (Tier B).

. For sites containing only radiomiclides, hazardous waste quantity is calculated based on the activi'y content of the radiomeclides or radionuclide wastestreams associated with each source. For sites with both radionuclides and other hazardous substances, hazardous waste quantity is evaluated separately for the two types of hazardous substance for each source, and the values are then summed in determining the hazardous waste quantity value. The scale for scoring radiomuclide waste quantity was derived based on concepts of risk equivalence between radionuclides and other hazardous substances.

In the proposed rule, all radionuclides were automatically assigned a maximum default value for the toxicity factor. The final rule evaluates radionuclides individually on the basis of human toxicity, across a range of factor values based on the potential to cause cancer (i.e., cancer slope factors). Non-cancer effects are not considered for radionuclides because cancer is generally the most significant toxic

effect. Incorporated in the development of cancer slope factors are the type of radioactive decay; energy emitted during decay; biological uptake, distribution, and retention; and radiation dose-response relationship. Thus, across the set of scoring ranges used, radionnelides that are more potent carcinogens per unit activity new receive higher toxicity factor values than those that are less potent. The new toxicity scoring scale for radionuclides as derived in a manner consistent with the derivation of the existing carcinogenicity scale for other hexardous substances. Taken together, the new toxicity and hazardous waste quantity scales for radiomyclides result in a risk equivalence between radionuclides and other hazardous

Mobility of radionuclides in both the air and ground water migration pathways is evaluated in the same way as mobility for other hazardous substances; that is, on the basis of the chemical and physical characteristics of the radionuclide. Similarly, the bioaccumulation (and ecosystem bioaccumulation) potential factor is evaluated in the same way for radionuclides as for other hazardous substances. The final rule clarifies that radionuclides should be scored for these factors in all relevant pathways.

The persistence factor in the surface water migration pathway has been modified so that radiomiclides are evaluated solely on the basis of half-life, which for HRS purposes is based on both radioactive half-life and volatilization half-life. Sorption to sediments is not considered, nor are hydrolysis, photolysis, or biodegradation. Other than this change in the processes considered to estimate surface water half-life, the scoring of the persistence factor is the same for radiomiclides as for other hazardous substances.

The final rule extends to radionuclides the benchmark concept used throughout the HRS for weighting certain targets factor values. Measured levels of specific radiomuclides at potential exposure points are compared to benchmark levels, and additional weight is given to targets subject to actual contamination (Levels I and II). This approach for weighting target factors using benchmarks is similar for radionuclides and for other hazardons substances, although both the specific benchmark values used for radionuclides and the methods for deriving the values are different. Benchmarks for evaluating radionuclide contamination parallel those used for

other hazardous substances in that available Federal standards and screening concentrations are used when applicable. At sites with both radionuclides and other hazardous substances, each radionuclide and other substance is evaluated separately. If no individual substance equals or exceeds its benchmark, the ratios of the measured concentrations to the screening concentrations for cancer for radionuclides and other bazardous substances are added. Radionuclides are not evaluated using screening concentrations for non-cancer effects.

Specific benchmark values for radionuclides are in activity units instead of mass units, however, to reflect the appropriate measurement units for the level of radioauclide contamination. Radiomeclide benchmarks include drinking water maximum contaminant levels (MCLs) for both the ground water and the surface water/drinking water threat pathweys; Uranium Mill Tailing: Radiation Control Act (UMTRCA) standards for the soil exposure pathway; and screening levels corresponding to 10" individual cancer risk for inhalation or oral exposures, as derived from cancer slope factors, for all pathways and threats incorporating human health benchmarks. The radionuclide benchmarks are consistent with EPA's radiomuclide risk assessment methods in that they incorporate standard data or assumptions about contact/consumption rates for various environmental media and radiation dose-response, as well as the specific radiomaclide's type of decay, decay energy, biological absorption, and biological half-life. Furthermore, radiomuclide benchmarks for the soil exposure pathway account for external exposure (i.e., exposure to radiation originating outside the human body) from gamma-emitting radioactive materials in surficial material as well as from ingestion, which is the sole basis for non-radioactive hazardous substance benchmarks for the soil exposure pathway, because external exposure from gamma-emitting radionuclides can be an extremely important exposure route.

F. Mobility/Persistence

The proposed rule added mobility factors to both the ground water and air migration pathways and modified the persistence factor in the surface water migration pathway to consider a greater number of potential degradation mechanisms.

The Agency received a large number of comments critical of several aspects

of the ground water mobility factor. The most creamen ippens acloded: • Concern about the use of coefficients of agreem migration to establish mobility values for inorganic نت ای ب

no that exhability values.

one we want to control to colory
on for minor and colors; and
Requests that the same measures of
ally be used for organics and

Criticism of the use of the coefficients equence migration focused on its coefficient or its config. Group! for geochemists, few miles are familier with the massesses. er with the measure. in response to these comments and re coefficients of aqueces ion are not available for all cardina substances and uclides, the Agency decided to nince coefficients of aqueous

The majority of commenters stated a preference for using parameters related either to hexardous substance release shibility) or to transport (distribution officients) as measures of mobility. o ground water mobility factor is The grand water mounty

The grand to palect the fraction of a hazardous substance expected to be released from sources, migrate through porous madia, and contaminate aquifers post media, and contaminate aquifies of the drinking water wells that cleav on them. Became mobility is occurred with both release and mapast, the Agracy concluded that obility for all becardous substances in mounty for all historious substances in ground water will be evaluated using both solubility and distribution coefficient values. A default value is assigned when none of the hexardous substances eligible to be evaluated can be assigned a mobility factor value based on available data.

iber of commenters raised one about the pursistence factor in ne surface water migration pathway. In macril, the communicatives were divided structs those who wanted more agradation machanisms considered d these who believed the equation in the proposed rule for calculating half lives was too complex. Several commuters suggested including sorption of substance by sediments. g balf-

In response to these comments. EPA has made several changes to the persistence factor. The free-radical exidation half-life has been dropped from the equation used to calculate halflife because the data on which its half-life values are bosed are typically derived from ideal, laboratory conditions that differ greatly from conditions found in nature: few field validation studies have been conducted to provide a besis for extrapolating

these laboratory values to natural enviconments. Thus, EPA concluded that including free-radical oxidation in the persistrace equation resulted in an overemphasis of the influence of freeradical oxidation es a degradation machanism. For hexardous substances that sorb readily to perticulates found in natural water bodies, the persistence iction as proposed overcombasized the importance of degradation sistes that occur in the liqu ase. Log K.... the logarithm of the aoctanol-water partition coefficient, has been added to account for scrption to

The Agency received several comments concerning the mobility factors in the air migration pathway. The most significant of the issues raised by commenters were:

 Whether consideration of mobility in both the likelihood of release factor category and the waste characteristics

cter category counts mobility twice; • Whother the approach used in the proposed rule properly reflected the dynamics of releases of gases from sources into the atmosphere; and
• Whether the Thornthwaite P-E

ladex was sufficient as the sole mas of particulate mobility and whether particle size should be included.

in response to these and other related structural and air migration pathway comments, the Agency thoroughly re-assessed the adequacy of the mobility assessed the adequacy of the mobility factors in the likelihood of release and waste characteristics factor categories. Based on this review, EPA has m several changes to the mobility factors in the final rule. In response to the double counting" issue, the Agency believes there are differences between mobility in the context of likelihood of release and mobility in the context of waste characteristics. The potential to release mobility factor is a measure of the likelihood that a source at a site will release a substance to the air; the was characteristics mobility factor, together with the hazardous waste quantity factor, is a measure of the magnitude of release. To highlight these differences, release. To highli the names of the likelihood of release mobility factors have been chanced to gas (or particulate) migration potential.

In response to comments on air migration pathway mobility and structure. EPA reviewed gas and particulate release rate models to develop revised mobility factors that improve evaluations of release magnitude and duration. The gas and particulate mobility factors in the final rule are a result of that review. The gas mobility factor is based on a simplified release model and is determined by the vapor pressure of the most toxic/mobile

hazardous substance available for migration to the atmosphere at the site.
The particulate mobility factor is based on a simplified fine-particle windto a surprise model and reflects the combined effects of diffusing wind speeds and soil . moisture. Analyses indicated that soil moisture was deminant over both wind mossure was dominant over both wind spood and particle size, which are essentially equal in effect. Because of the compensative difficulty of determining particle sizes in an SI, a single particle size was assumed to apply to all sites. This constant particle size value was factored into the e was factored into the aine value was incomes now simplified model yielding the factor in he final rule.

G. Observed Release

The proposed HRS described how to stanuing whether on observed release was significantly above background levels based on multiples of detection limits and background concentrations.

Some commenters stated that the reposed revisions treated observed release in an overly complex manner. A mber of commenters, primarily from he mining industries, were concerned about the consideration of background concentration in determining an observed release. (See Section III P below for a sur pary of their concerns and EPA's response.)

As in the proposed rule, observed releases may be established based on either direct observation or chemical analysis of samples. In the case of direct observation, meterial (e.g., particulate natter) containing hexardous substances must be seen entering the an directly or must have been deposited in the mos

EPA has replaced the proposed rule criteria for establishing an observed ese by chemical analysis with simpler criteria. In the final HRS, an observed release is established when a sample measurement equals or exceeds the sample quantitation limit (SQL) and is at least three times above the background level, and available information attributes some portion of the release of the hazandous substance to the site. (The SQL is the quantity of a bezardous substa ace that can be reasonably quantified, given the limits of detection for the methods of analysis d sample characteristics that may affect quantitation (e.g., dilution, concentration].) When a background concentration is not detected (i.e., below detection limits), an observed release is established when the sample measurement equals or exceeds the SQL. Any time the sample measurement is less than the SQL, no observed release is established. Table 2-3 of the

final rule provides the criteria for determining when analytic sampling information is sufficient for establishing an observed release (or observed continuiantion in the soil exposure pathway). The final rule also provides procedures to be followed when the SQL is unavailable and defines various types of detection and quantitation limits in the context of the HRS. (See § 2.3 of the final rule.)

H. Benchmarks

SARA requires that EPA give high-priority to sites that have led to closing of drinking water wells or contamination of principal drinking water supplies. To respond to this mandate, the proposed rule added health-based benchmarks to the ground water and surface water migration pathways; in addition, ecological-based benchmarks were added to evaluate sensitive environments targets in surface water. In the proposed rule, population factors were evaluated at Level I if a health-based benchmark had been exceeded. If actual contamination was present, but the benchmark was not exceeded, populations were evaluated based on two levels of contamination (i.e., Level II and Level III). Sensitive . environments in the surface water migration pathway were evaluated based on two levels of actual contamination (exceeding benchmark or not exceeding benchmark). Where , several hazardous substances were present below benchmarks, the percentages of their concentrations relative to their benchmarks were added to determine which level was used to assign values.

Of the commenters on this issue, most supported EPA's proposal to give extra weighting to sites where measured exposure-point concentrations exceed benchmarks. One commenter who dissented suggested giving extra weighting to sites where actual ' documentation of an observed release (or observed contamination) would be the only criterion for assigning higher values to target factors, and the relationship of the concentration of hazardous substances to benchmarks would not be used. The other dissenting commenter suggested that EPA reevaluate the role of health-based benchmarks in the HRS because common sense, and other laws, will discourage people from drinking water contaminated above benchmark levels. and because evaluating this factor will entail large resource expenditures for marginal gains in discrimination.

The final rule weights most targets based on actual and potential exposure

to contamination across all pathways and threats, including those for which benchmarks were not originally proposed, because EPA believes that this approach both improves the ability of the HRS to identify sites that pose the greatest threat to human bealth and the environment and increases the internal consistency of the HRS. (See §§ 2.5, 251, 252, 331, 332, 41231, 41232, 41331, 41332, 41431, 42231, 42232, 42331, 42332, 42431, 5.1.3.1, 5.1.**3.2, 6.3.1, 6.3.2, 6.3.4**, 7.3.1, 7.3.2.) In the final rule, both the population factors and the factors reflecting the hazard to the nearest individual for well or intake) are evaluated in relation to health-based benchmarks in all pathways. The sensitive environment factor in the surface water environmental threat is weighted in relation to ecological-based benchmarks; however, in the soil exposure and air migration pathways, the sensitive environment factor is weighted simply on the basis of exposure to actual contamination, and no benchmarks are used.

The Agency chose to use benchmarks in all pathways in response to comments that specifically suggested such a change; it is also responding to comments that the HRS should better reflect relative risks and that the approaches in all pathways should be consistent. The Agency has concluded that the concerns expressed by commenters outweigh the concerns about uncertainties in the evaluation of samples collected in air and soil and about the lack of regulatory standards and criteria on which to bese soil or air benchmarks that led the Agency not to include benchmarks for those pathways in the proposed rule. In short, EPA carefully considered this point and concluded that the consistent application of benchmarks across all pathways provides for the most reasonable use of data given the purpose of the HRS as a screening tool.

EPA generally selected specific criteria based on applicable or relevant and appropriate requirements (ARARs), excluding State standards, that have been selected for the protection of public health and the environment as outlined in the NCP (55 FR 8666, March 8, 1990). In the HRS NPRM, EPA proposed to use MCLs, maximum contaminant level goels (MCLGs), and screening concentrations (SCs) based on cancer slope factors as drinking water benchmarks, and Food and Drug Administration (FDA) Action Levels as benchmarks for the human food chain threat. EPA also proposed to use Ambient Water Quality Criteria

(AWQC) as ecological-based benchmarks for the environmental threat. EPA received 21 comments from 12 commenters on which benchmarks the HRS should use and whether additional information should be considered in establishing benchmarks. Opinion was divided on the use of specific types of benchmarks: three commenters supported the use of MCLs: three did not. Two commenters supported the use of MCLGs, two opposed such use, and one suggested that EPA consider the economic impact of using the value of 0 (i.e., the MCLG for a carcinogen) as a health-based benchmark. Two commenters suggested including relevant State drinking water standards, and one suggested including concentrations based on RfDs. One commenter expressed concern that the current lack of water quality standards for many substances might make the benchmark system ineffective in identifying sites that pose a significant threat to human health. Two commenters suggested that carcinogen weight of evidence should be used in establishing SCs (e.g., the individual risk level should be lower for a Class A carcinogen than for a Class B2 carcinogen). Two commenters suggested considering other important routes of exposure (e.g., inhalation of hazardous substances volatilized from water, or dermal contact with contaminated water) in establishing drinking water benchmarks.

EPA conducted a number of analyses on specific benchmarks and on the modification of factors to consider in establishing HRS benchmarks. As a result of public comments and these analyses, EPA has concluded that the HRS is improved by including concentrations based on nationally uniform standards, criteria, or toxicity values as health-based or ecologicalbased benchmarks in all pathways and threats. EPA's conclusion is based on several considerations. First, the addition of benchmarks across all pathways and the use of ARARs for those benchmarks improves linkages with the RI/FS process. That is, the HRS benchmarks will be those used most frequently during RI/FSs, and the additional points provided by equalling or exceeding a benchmark will aid in identifying areas requiring follow-up in the RI/FS. Second, the internal consistency of the HRS is improved by using benchmarks because concentrations measured at or above benchmark levels are treated in a parallel manner across all pathways. allowing more consistent and fuller use of the relatively costly sampling data

collected during the SI. Third, the number of hersedous substances for which at least one health-based or ecological-based benchmark is available acressed, allowing for more uniform ent of sites noticewide.

The benchmark criteria that the Agency has concluded are most oppropriate for each pathway and threat are listed below. As discussed above. EPA agrees with comments suggesting that beachments also be used in the soft exposure and air migration pathways and has selected criteria for these athropys based upon the kinds of factors discussed above. While EPA believes the criteria for the soil se and air migration pathways in the final rule are appropriate, it is open to any commants that members of the public may wish to animals regarding neso culturie and specifically solicits tch comments at this time. IPA asks ut any such comments be submitted es (30 days after the date of shiication in the Federal Register). For the final rule; IPA has selected

the following types of benchmarks in each pathway and threat, subject to an periodogs in the criteria for air and soil exposure that may be made in response to comments. (Buschmarks for redispunities are discussed in Section

E ef this pros ile)

igration padway and the surface wher delaking water throat include MCLs, non-noro MCLGs, screening concentrations (SCs) for non-cancer effects based on REDs for and see, and SCs for cancer based on slope factors for etal expenses and 10⁻⁰ individual cancer risk (one Table 3-10). Because SCs based on RfDs and slope factors are used as drinking water beachmarks, MCLGs with a value of 0

have been dropped as HRS benchmarks.

• Buschmarks in the surface water luman food choin threat include PDA Action Levels for fish or shellfish, SCs for non-concer effects based on RfDs for oral exposures, and SCs for concer-based on slope factors for aral exposures and 10⁻⁶ individual concerexposures and 10⁻⁴ individual cancer risk (see Table 4-17).

• Benchmarks in the surface water

environmental threat include AWQC and Ambient Aquatic Life Advisory
Concentrations (AALACs): AALACs will be considered as they become available (see Table 4-22).

mels in the soil exposure way include SCs for non-concer effects based on RIDs for oral exposures, and SCs for concer based on slope factors for oral exposures and 10⁻⁶ individual cancer risk (see Table 5-3).

· Benchmarks in the air migration pathway include National Ambiest Air Quality Standards, National Emission eds for Ha ardons Air Polletants (NESHAPs) that are expressed in ambient concentration units, SCs for non-cancer effects based on RiDs for inhalation exposures, and SCs for cancer based on slope factors for inhalation exposures and 10" individual cancer rick (see Table 5-14).

Several commenters suggested echnical refinements for deriving health-based benchmarks. Althou qualifying information is useful and portant and is, in fact, used asively in the RI/PS process, the bunelits of including such information in the FRS must be belanced against its limited scope and purpose as well as the limited data available to determine concentration at the point of exposure.
Consequently, in the final rule:

 All health-based benchmarks are rence to the major expes aet in refi concern for each pathway or threat (e.g., benchmarks in the air migration pathway are set in reference to inhelation only; benchmarks in drinking water, the human food chain threat, as the sell exposure pathway are set in reference to ingestion), except for radionaclides for which external exposure is also considered in the soil

exposure pathway;

• All banchmarks are set in reference to uniform exposure assumptions that are consistent with RI/PS procedures (e.g., water consumption is assumed to be two litters per day; body weight is

med to be 70 kg;

· State water quality standards and other State or local regulations are not included as benchmarks because they dations are not would introduce regional variation in the HRS:

 A hierarchy has been developed to provide a single benchmark concentration for each hazardous substance by pathway and threat; and
• Qualitative weight-of-evidence is not used in deriving SCs for carcinoges

to the NPRM, EPA requested nents on how many tiers (levels) of actual contamination to consider wh weighting populations relative to benchmarks (i.e., which of three alternative methods presented should be adopted). EPA received two comments on this issue and three related comments regarding the weighting factors for each level. One commenter supported Alternative 2 (i.e., use of two levels of observed contamination and one level of potential contamination). Another commenter suggested that Level II and Level III concentrations be combined to include the range of contaminant levels above background. but below health-based benchmarks. A third commenter suggested that the

weighting factors for each level be end. A fourth comment mested that Your of a beachmark factor is inappropriate because it is excessively conservative and difficult to detect. The fifth commenter succested that because Level III represents itations with cancer risks below 16", populations exposed to Level III concentrations should not be considered in the population category of drinking water threats.

RPA conducted a number of analyses on the subject of benchmark tiers and has dropped Level III contamination. In the final rule, Level I contamination is defined as concentration levels for targets which must the criteria for actual contamination (see § 2.5 of the final rule) and are at or above media-specific benchmark levels; Level R contomination is defined as concentration levels for targets which either meet the criteria for actual contamination but are less than media-specific benchmarks, or most the criteria for actual contamination based on direct observation; and potential contamination is defined as targets that are potentially subject to releases (i.e., targets that one not associated with actual contamination for that pathway or threat). These fiers tiers are used to essign values to both the nearest assign values to both the mearest individual (or well or intake) and the population factors. As a result of EPA's analyses of brackmark issues, the weighting assigned to Level I and Level II contamination has been changed and ulation factors. As a result of EPA's Il continuentes mes uses pathways. For example, Level I populations are now multiplied by a factor of 10 in all pathways. As in the proposed rule, potentially contaminated populations and assess individuals (or wells or inteles) are distance or dilution

The proposed rule summed the ratios all hexactions substances to their of all hozardous individual basch marks as a mouns of defining the level of actual contunination, and EPA requested comments on the appropriateness of this approach to scuring multiple substances detected in drinking water. Of the 10 ments in response to this proposal, nine strengly opposed the proposed approach, particularly when applied to drinking water standards (i.e., MCLs), MCLGs, and noncarcinogens. One commenter supported the proposed approach.

EPA has decided to retain the ming of ratios of hazardous stances to their individual benchmarks, but in a modified form. The final rule sums measures of carcinogenic and soncarcinogenic effects separately:

concentrations specified in regulatory limits (e.g., NAAC'S, MCLs, or FDA Action Levels) are not included in the summing algorithm. EPA recognizes that a more precise estimate of relative risk would be obtained by summing the ratios of hazardous substances to their ir dividual RfD-based concentrations by segregating substances according to major effect, target organ, and mechanism of action. In fact, such a segregation is recommended during the RI/FS. However, health-based benchmarks are used in the HRS to provide a higher weight to populations exposed to hazardous substances at levels that might result in adverse health effects. As a consequence, EPA believes that use of the summed ratios of hazardous substances within pathways and threats to their individual RIDbased benchmark levels is appropriate for the screening purpose of the HRS.

EPA proposed and solicited comments on a range of 10⁻⁴ to 10⁻⁷ for individual cancer risk levels of concern in establishing levels of actual contamination with respect to health based benchmarks. EPA received eight comments concerning this risk rang Pour commenters suggested restricting the range to 10⁻⁴ to 10⁻⁴, primarily because this range would be consistent with risk levels identified in the NCP and used by other EPA regulatory programs. Three commenters said the SCs for carcinogens should be the 10-6 individual cancer risk level. One enter stated that 10⁻⁴ to 10⁻⁷ generally is the risk range considered for Superfund response. The final rule defines only two levels of actual contamination: significantly above background and equal to or above benchmark, and significantly above background but less than benchmark. When sa applicable or relevant and appropriate requirement does not exist for a carcinogen, EPA selects remedies resulting in cumulative risks that fall within a range of 10⁻⁴ to 10⁻⁶ incremental individual lifetime cancer risk based on the use of reliable cancer potency information. EPA has selected the 10⁻⁶ screening risk level in defining the HRS benchmark level for cancer risk because it is the lower end of the cancer risk range (i.e., 10" to 10") identified in the NCP and used by other EPA regulatory programs.

Two commenters objected to assigning releases of substances with no benchmarks to Level II as a default value. One suggested assigning unknowns to Level III because substances that are frequently released or are known or suspected to cause health problems are studied before

those that are not. The other objected because "the absence of data is not data."

Because EPA has decided to adopt a benchmark system incorporating only two levels of actual contamination, the default level is Level II. If none of the hazardous substances eligible to be evaluated at a sampling location has an applicable benchmark, but actual contamination has been established, the actual contamination at the location is assigned to Level II.

I. Use Factors

The proposed FRS included factors to assign values to uses of potentially affected resources in the three migration pathways: ground water use (drinking water and other) in the ground water migration pathway, drinking water and other use and fishery use in the surface water migration pathway, and land use in the air migration pathway.

EPA received a number of comments on each of these factors. The commenters raised specific objections to distinctions drawn among various potential uses and to the weights assigned to those uses. For example, for the ground water use factor, som commenters asserted that the HRS should not delineate between private and public water supply contamination. For the surface water use factors, a commenter recommended a range of assigned values for irrigation of commercial food or forage crops because of variations in rates of uptake of hazardous substances. For the land use factor, two commenters arged giving greater consideration to institutional land use because of the sensitive populations that would be exposed.

Partly in response to these comments. and in an effort to simplify the HRS. EPA has substantially revised the method of incorporating resource us information in targets factor categories. The field test indicated that collecting data on each of the use factors involved considerable effort at many sites. In consideration enters at many some. addition, because of weighting factors applied to potentially contaminated populations, at sites with no actual contamination, use factors were contributing more to the targets value than were large populations. As some commenters pointed out, the use factors mixed concerns about human health with concerns about the value of the resource and, therefore, were partially redundant with population factors. To avoid redundancy with human health concerns as evaluated through the population factor, EPA has made major changes in how resource uses are evaluated and scored in the final rule.

In each migration pathway, the use factors have been replaced by a resources factor that assigns values to resources appropriate for the pathway. In addition, a resources factor has been added to the soil exposure pathway. The resources factor for a pathway is assigned a maximum of five points if any of the resource uses for that pathway exists within the target distance limit in the ground water or surface water migration pathway, within one-half mile of a source in the air migration pathway, or within an area of observed contamination in the soil exposure pathway. If none of the uses exists, the factor is assigned a value of

The resources factor in the ground water migration pathway assigns a value of 5 for wells supplying water for irrigation of commercial food or commercial forage crops (five-acre minimum), watering of commercial livestock, as an ingredient in commercial food preparation, or as a supply for commercial aquaculture or for a major or designated water recreation area (excluding drinking water use)—for example, water parks (see § 3.3.3). A value of 5 is also assigned if the water in the aquifer is usable for drinking water, but not used.

The resources factor in the drinking water threat of the surface water migration pathway assigns a value of 5 if the surface water is designated by a State for drinking water use but not used, or is usable but not used for drinking water. In addition, points may be assigned for intakes supplying water for irrigation of commercial food or commercial forage crops (five-acre minimum), watering of commercial livestock, as an ingredient in commercial food properation, or if the water body is used as a major or designated water recreation area (see § 4.1.2.3.). The fishery use factor has been deleted to avoid double-counting of fisheries.

In the air migration pathway, the resources factor is assigned a value of 5 if there is commercial agriculture or commercial siviculture, or a major or designated recreation area within a half mile of a source [see § 6.3.3). The distance of one-half mile for the agricultural, silvicultural, and recreational areas was determined by the distance weighting factors for the air migration pathway, which reflect the rapid dimmissing of air contaminant concentrations beyond one-half mile from a source. Therefore, resources beyond this distance are not considered in this pathway.

A recource factor has also been added to the resident population threat of the seil exposure politivey. The factor is assigned a value of 5 if there is commercial agriculture, commercial salviculture, or commercial livestock production or grazing on an area of observed contamination at the site.

J. Sensitive Bevironments

The proposed rule expended the list of sensitive environments considerably and. For the surface water and air pathways, counted all sensitive environments within the target distance limit, tather than just the use with the highest angigned value; for the soil exposure pathway, only the sensitive environment assigned the highest value was counted. Potentially contaminated sensitive environmental threat, actual contempation of smalltwie environments were distance/dilution weighted; in the surface water environmental threat, actual contempation of smalltwie environments were evaluated on the basis of sensitive distance.

scological-bised bunchmarks.

IPA received selectively few comments on issues related to sensitive environments. However, participants in the field test requested classification of these categories of smaltive environments involving spawning areas, nigrotery pathways, and feeding areas critical for the maintenance of a fish species within a river system, coastal embayment, or estuary. In particular, critical migratery pathways and feeding areas were difficult to identify and seemed to provide little discrimination among surface waters in some areas of the country.

EPA has redefined critical spawning a ves to include shellfish bods, and has limited the areas to these used for intense or concentrated spawning by a given species. Critical inigratory pathways and feeding areas have been combined into a single category and limited to anadromous fish (i.e., fish that accend from the ocean to spawn), which face special problems in migrating substantial distances between the ocean and their spawping areas. These feeding areas are further metricted to only those areas in which the fish spend extended periods of time. Examples include areas where juvaniles of mediconous species feed for prolonged periods (e.g., weeks) as they prepare to migrate from fresh water to the ocean, and holding areas along the adult migratory pathways.

Terrestrial areas used for breeding by large or dense appregations of vertebrates (e.g., herou rookery, sea lion breeding beach) have been added to the list of sensitive environments to parallel the spewning areas listed for fish species. Water segments designated by a State as not attaining toxic water

quality standards have been removed because those environments are already degraded and thus are not analogous to the other sensitive environments listed. Also, the assigned value for State designated areas for protection or maintenance of squatic life has been changed from 50 points to 5 points (see Table 4-23 in final rule) to be consistent with the points assigned under the resources factor for State designated areas for drinking water use.

In response to public comment, National Monuments have been added to the 100-point category on the list of terrestrial amostive environments considered under the soil expoure puthway. "State designated natural areas" and "particular areas, relatively small in size, important to the maintanance of unique biotic communities" were also added to the list of terrestrial sensitive environments in response to public comment. These latter two categories were already considered in the air and surface water pathway evaluation of sensitive environments. (See Table 5–5.)

evironments. (See Table 5–5.)
The method for evaluating wetlands has been revised, partially because participants in the field test had difficulty identifying discrete wetlands. Some wetlands were patchy and could be classified as one large or many small wetlands. Other wetlands were divided by rivers or roads, or changed from one type of wedland to another, making it er whether more than one wetland ould be counted. To eliminate these difficulties, wetlands are now evaluated on the basis of size and level of nation. In the air migration pathway, wetlands are evaluated based s acreage and level of contamination (ase § 8.3.4); in the surface water migration pathway, wetlands are evaluated by linear frontage along the erface water hezardous substance igration path and level of tion (see § 41.43.1). Distinguishing among wetlands on the basis of size and level of contamination sould improve the discriminating ability of the sensitive environments factor. In the drier portions of the constry, where even small wetlands (e.g., prairie potholes) are very rtent, small wetlands may also alify as "particular areas, relatively nell in size, important to the maintenance of unique biotic milies.

Sensitive environments other than wetlands are not evaluated on the basis of size for several reasons. Most other HRS sensitive environments tend to be less common and less widely distributed nationally than wetlands (e.g., see EPA's 1989 Field Test of the Proposed Revised

HRS) and, therefore, their numbers and boundaties tend to be easier to identify. In addition, the value of many sensitive environments is independent of size; for example, the size of a critical habitat of an endangered species may vary solely due to the type of species present. Furthermore, potential or actual contamination of even a small portion of many sensitive environments—for example, a wildlife refinge—tends to be viewed as unnoceptable.

An ecosystem bioaccumulation potential factor has been added to the aste characteristics factor category of the surface water environmental threat in sesponse to comments that hexardous nces that demonstrate an ability to bind to sediments and/or to bioscomulate (e.g., PCBs, mercury) tend to pose the greatest long-term threats to aquatic organisms. The accumulation of Ale argu idous substances in the aquatic food chain can result in adverse effects in aquatic species and in other animals that ingest equatic species (e.g., waterfowl). The ecosystem bioaccumulation potential factor differs slightly from the bioaccumulation potential factor in the human food chain threat, primarily in that all BCF data are red in deriving it and not just BCF data for human food chain

The EPA ambient aquatic life advisory concentrations (AALACs) have been added to the data hierarchy used to assign the occupytem toxicity value (see § 4.1.4.2.1.1). The Natural Heritage Program alternative sensitive environment rating factors have been removed from the rule because of problems that arose during the field tests; field test participants found that the availability of information varied substantially among States. However, a Natural Heritage Program Data Center can assist in identifying stany of the sensitive anvironment types listed in Tables 4-23 and 5-5.

Tables 4–23 and 5–5. K. Use of Available Data

A number of commenters stated that all available data should be used when scoring a site. Several cited the tiered approach to hazardous waste quantity as a model that could be applied to other factors. Under this method, where data are available, they would be used; where data are not available, defaults or more generalized approaches would be applied. Several commenters specifically suggested using this approach for ground water flow direction and for scoring mining sites. These commenters argued that it would be less expensive and time-consuming to use available data when scoring a site

than to wait until the remedial investigation to consider the additional information.

EPA considered modifying the HRS to allow the use of additional data, but determined that further expanding the HRS to account for varying levels of data availability is inconsistent with the HRS's role as an initial screening tool. Adding tiers to various factors to accommodate the use of all available data would make the HRS considerably more difficult to apply and could lead to substantial inconsistencies in how sites are investigated and evaluated. EPA Regions and States would have to determine, for each set of data presented, whether the data quality was good enough for the data to be considered. Debates over decisions on data quality could delay scoring and. ultimately, delay cleanup at sites Therefore, the Agency believes that the limited use of tiers in the final HRS represents a reasonable tradeoff between the need to limit the complexity of the system and the desire to accommodate risk-related information that is generally outside the scope of a site inspection.

L. Ground Water Migration Pathway

The proposed rule included a number of significant changes in the ground water migration pathway: new hydrogeologic factors were added;

populations were distance weighted unless exposed to actual contamination; a maximally exposed individual (MEI) factor was added; the target distance limit was extended; a mobility factor was added and combined with toxicity; and a wellhead protection area factor was added. Figure 5 shows the proposed ground water migration pathway and the final rule pathway.

Ground water flow direction. Neither the original HRS nor the proposed HRS directly considered ground water flow direction in evaluating targets. The proposed HRS indirectly considered ground water flow direction by weighting populations based on actual and potential contamination of drinking water wells.

EPA received 50 letters from 40 commenters on this issue; 27 letters responded to the ANPRM, 21 to the NPRM, and two to the field test report. Commenters included eight States, three Federal agencies, the mining, petroleum, chemical, and cement industries, utilities, and professional engineers. The commenters supported the consideration of ground water flow direction data, at least in some circumstances. Numerous commenters urged the use of ground water flow direction data when they are either available or easily obtained. They suggested several methods to incorporate flow direction, including:

 Considering use of a radial impact area when directional release routes can be determined. Only a half circle with a three-mile radius for the downgradient portion (and a half-mile radius for the rest of the circle) should be considered when scoring;

 Differentiating between upgradient and downgradient areas using topographic maps, evaluating water levels at wells, and noting the presence of major surface water bodies;

 Expending the effort to obtain accurate data and considering selected upgradient locations as a precaution against unanticipated anomalies;

 Excluding drinking water wells where analytical data prove no contamination is present;

 Having a "professional" review available information and conduct a site visit.

 Using available flow direction data and developing regionally based defaults when no data are available;

 Installing piezometers to determine flow direction in the PA/SI phase and when no ground water flow data are available;

 Incorporating ground water flow direction into the "depth to aquifer" and "distance to nearest well/population served" acores; and

 Affording responsible parties the opportunity to determine flow direction.

Figur 5

Ground Water Migration Pathway

PROPOSED HRS

Likelihood of Release X	Waste Characteristics - X	Targets
Observed Release Or Potential to Release Containment Net Precipitation Depth to Aquifics/ Hydraniic Conductivit Sorptive Capacity	* Toxicity/Mobility Hazardous Waste Quantity	Maximally Exposed Individual Population Ground Water Use Welthead Protection Area

FINAL HRS

Likelihood of Release	X	Waste Characteristics X	Targets
Observed Release or Potential to Release Containment Net Precipitation Depth to Aquifer Travel Time		Toxicity/Mobility Hazardous Waste Quantity	Nearest Well Population Resources Wellhead Protection Area

BELLING COME COMP-CO-C

Commenters suggested that data on ground water flov: are either readily available or can be easily obtained at reasonable cost and are no more imprecise than other aspects of the HRS. Some commenters stated that the level of effort required to estimate the Circuiton of ground water flow is no greater than that required to determine other hydrogeologic parameters in the HRS.

EPA reviewed a range of options for considering ground water flow direction in evaluating targets. For the reasons discussed above under "Use of Available Data," the Agency decided that it was not feasible to adopt a tiered approach in the targets factors for evaluating ground water flow direction. EPA does not agree that increased accuracy warrants the increased complexity of accounting for ground water flow direction, because this level of accuracy is not required for a screening tool that is intended to assess relative risk. This level of accuracy, however, is needed to determine the extent of remedial action and, therefore, is appropriate at the time of the RL

EPA disagrees with the argument that determining ground water flow direction is no more difficult than determining other ground water factors. Aquifer interconnections and discontinuities as well as hydraulic conductivity and depth to aquifer, which are evaluated in the final rule, are geologic features that are unlikely to change over the shortterm. In contrast, ground water flow direction can be influenced by factors such as seasonal flows and pumping from well fields. In addition, the ground water flow direction may be different in each aquifer at the site, and the direction of hazardous substance migration is not always the same as the direction of ground water flow. Therefore, data on ground water flow direction would need to be considerably more extensive than would the data required to document the other hydrogeologic factors. EPA notes that in the final rule, many of the other hydrogeologic factors considered have been simplified and the sorptive capacity factor has been dropped. EPA also notes that ground water flow direction was not identified in SARA as a portion of the HRS requiring further examination, even though ground water flow direction was not considered in the original HRS and the Agency had received criticism similar to the above comments prior to enactment of SARA.

Although the final rule does not consider ground water flow direction directly in evaluating targets, it does consider flow direction indirectly in the method used to evaluate target populations. If wells have not been contaminated by the site, as the commenters assume upgradient wells would not be, the population drawing from those wells is distance weighted and, thus, populations drawing from the wells would have to be substantial before a large number of points could be assigned. Moreover, in addition to providing a measure of the population at risk from the site, the target factors afford a measure of the value of the ground water resources in the area of the site and of the potential need for expanded uses of the ground water.

Aquifer interconnections. Aquifer interconnections facilitate the transfer of ground water or bazardous substances between aquifers. The final rule specifies that if aquifer interconnections occur within two miles of the sources at the site (or within areas of observed ground water contamination attributed to sources at the site that extend beyond two miles from the sources), the interconnected aquifers are treated as a single aquifer for the purposes of scoring the site. Thus, for example, when an observed release to a shallow aquifer has been identified. targets using deeper aquifers interconnected to the shallow aquifer are included in the evaluation of the combined aquifer. This approach is common to the original as well as the revised HRS.

In practice, EPA has found that studies in the field to determine whether aguifers are interconnected in the vicinity of a site will generally require resources more consistent with remedial investigations than SIs, especially where installation of deep wells is necessary to conduct aquifer testing. Thus, EPA has in the past relied largely on existing information to make such determinations and the Agency finds it necessary to continue that approach. Examples of the types of information useful in identifying aquifer interconnections were given in the proposed rale. This information includes literature or well logs indicating that no lower relative hydraulic conductivity layer or confining layer separates the aquifers being assessed (e.g., presence of a layer with a hydraulic conductivity lower by two or more orders of magnitude); literature or well logs indicating that a lower relative hydraulic conductivity layer or confining layer separating the aquifers is not continuous through the two-mile radius (i.e., hydrogeologic interconnections between the aquifers are identified); evidence that withdrawals of water from one aquifer (e.g., pumping tests,

aquifer tests, well tests) affect water levels in another aquifer; and observed migration of any constituents from one aquifer to another within two miles. For this last type of information, the mechanism of vertical migration does not have to be defined, and the constituents do not have to be attributable to the site being evaluated. Other mechanisms that can cause interconnection (e.g., boreholes, mining activities, faults, etc.) will also be considered. While the descriptive text has been removed from the rule, the approaches mentioned in the proposed rule will be used in making aquifer interconnection determinations. In general, EPA will bese such determinations on the best information available; in the absence of definitive studies and where costs of field studies are prohibitive, the Agency will rely on expert opinion (e.g., U.S. Geological Survey staff or State geologists). In the absence of such information, EPA assumes that aquifers are not interconnected.

Ground water potential to release factors. EPA proposed replacing the depth to the aquifer of concern and parmeability factors of the original HRS with depth to aquifer/hydraulic conductivity and sorptive capacity factors. EPA received more than 75 comments on these factors, in addition to general comments on evaluating ground water potential to release in response to the ANFRM.

Several commenters supported consideration of depth to aquifer in evaluating the ground water migration pathway. One commenter stated that use of a depth to aquifer/hydraulic conductivity matrix, which was intended to reflect travel time to ground water, was an improvement over considering these two parameters individually and additively. Concerns were raised, however, about how to determine depth to aquifer. In addition. commenters stated that the two-mile radius for evaluating hydrogeologic factors should be extended to four miles. while others commented that the distance should be measured from vertical points as near to the source as possible.

Commenters generally supported the proposal to include hydraulic conductivity, although many believed that the proposed method was too complicated; several commenters suggested that the single least conductive layer(s) should be used. Another concern was the lack of data for determining hydraulic conductivity. One commenter stated that unless data can confirm that the geologic strata

extend throughout the entire area of a site, earliesing a hydraulic conductivity value is highly questionable. Some commentees offered alternative

aches to evaluating hydroulic activity. These included replact ed replacing pered method with: demed "confidence levels" tied to

ral estimates based on regional

enfections committee and judgment;
- Consideration of actual travel time enstanted room or و مثأ ط

the conduction

hydraciic conductivity among the various guslegical layers below the site.

More than 20 comments were received as the surptive capacity factor, but these was little consensus among the commentum. A number of commentum. ed that the factor should be added. agreed that the miner survey or some, but stated that the approach was not detailed enough and that more west-and also specific information about he required. Other commenters agreed that the factor was an improvement, but said the factor was an improvement, but said that suptive capacity should be dropped because the waste- and site-specific information needed for an accurate evaluation named be collected. chains a screening process. Others said that it was too complex as proposed and ist it was too complicated be dropped. Based on these can

Based on those comments and the field test remits, EPA examined the clepts to applier/leptendic conductivity as supplier capacity factors. The examination showed that the lowest hydrodic conductivity layer(s) accounted for showed all of the terms. eccepted for almost all of the travel accounted for immers an or one excep-time to the equilier if a one-foot or three-foot minimum layer thickness was used. Accordingly, in the final rule, the depth to equilier/legistelic conductivity factor has been replaced with a simpler factor, travel time, which is determined using a matrix of the hydraulic conductivity and dickness of the lowest hydraulic conductivity inper(s) with at least a firee-fost thickness. (See § 3.1.24 and Table 3-7 of the final role.)

To conform with the change lim the travel time factor to the least ee licitine conductive layer(s), and to meet the goal of simplification, a change to the scriptive capacity factor was necessary. The proposed rule evaluated this factor

using all layers between the source and the aquific. In recommining this factor, EPA concluded that depth to aquifer is one of the major parameters affecting HRS ranges for the factor. Doyth to aquifer also indirectly reflects ochamical paterdation mach because, all also being equal, the effect of these saturdation mechanisms personne to depth to aquifer screenes. At the field test sites, using ply the input(s) of lowest hydroxic publicity (s) howest the calculated priority content in calculated priority cannot be a second priority (s). serbent ca had between 10 q percent. For those reasons, EPA has decided to replace the soxptive capacity factor with a depth to aquifer factor.
[See § 3.1.23 and Table 3–5 of the final

M. Surface Water Migration Pathway

The proposed rule made major changes to the evaluation of releases or freetaned releases to surface water. The pathway was divided into four threats: drinking water, human feed chain, recreational use, and ental. Other changes inch consideration of flood potential; revision utiel overland flow; addition of dilution weights for potentially contemioned populations; extension of the target distance limit to 15 miles: sevision of the persistence factor to consider more degradation mechani addition of a bioaccumulation factor for etion of human food chain testicity/persistence and populations; addition of ecosystem texticity to evaluate the environmental threat; and addition of a maximally exposed individual factor (MEI) factor to the drinking water threat. Pigure 8 shows the proposed rule and the overland Sow/flood migration component of the surface water migration pathway in the finel rule.

Recreational use threat. SARA stated that the HES should consider threats to surface water used for recreation and drinking water, and the proposed HRS included a recreational use threat in the serface water migration pathway. A umber of States, several companies and trade associations, and two Federal agencies identified problems with the proposed recreational user threat. Some commenters objected to weighting ft as heavily as the drinking water threat, while others suggested that evaluating the threat was too complicated for use in a screening tool. Many commenters said that proposed methods for assigning values to recreation areas were too knoodly drawn and that a limited number of recreation areas should be considered. Two commen sted using actual attendence data, and one commenter suggested that recreational uses he considered in other podrocys as well.

EPA's field test indicated that the recreational use threat evaluation was too complex for HRS purposes and, at e time, was not very accurate. the se Several field test participants commented that the speciation target ulation was difficult to evaluate and at the approach for determining ulation was inaccurate and time-runing. In addition, the population consuming, in column, and factor did not provide maningfu discrimination among situs. The proposed rule used the physical state for a, capital repeased rule used the physica: leasesteristics (e.g., capital spooresients) of a receastional site as se basis for determining the distance e basis for determining the distance mit used to evaluate population, but because major and miner sites have the same types of capital r alles may improvements (e.g., best ramps, picnic facilities), the same distance limit could be associated with a miner recreation ree and a unifer recreation area. The alternative approach would be to require actual use data to evaluate targets; however, site-specific population data are not evaluable for any recreation areas, making it icult to obtain accurate es he population at risk. The target distance limits, which ranged from 10 to 125 miles, also contributed to the problems with evaluating targets. The Agency invited comments on relining these calculations; no alternative app. reaches were suggested, and EPA did not identify viable alternatives.

MUSIC CHE CON-CO-CO

Figure 6

Surface Water Migration Pathway

PROPOSED HRS

Likelihood of Release

X

Observed Release or Potential to Release

By Overland Flow
Containment
Runoff
Distance to Surface
Water

By Flood Containment Flood Frequency

Drinking Water Threat

Waste Characteristics X Targets
Toxicity/Persistence Maximally Exposeu
Hazardous Waste Quantity Individual
Population

+

Surface Water Use

Human Food Chain Threat

Waste Characteristics X Targets
Toxicity/Persistence/ Population
Bioaccumulation Fishery Use
Hazardous Waste Quantity

Recreational Use Threat

Waste Characteristics X Targets
Toxicity/Persistence/Dose Population
Adjusting Factor
Hazardous Waste Quantity

Environmental Threat

Waste Characterisitics X Targets
Econystem Toxicity/ Sensitive Environments
Persistence
Hazardous Waste Quantity

Figu: 6

Surface Water Migration Pathway - Overland Flow/Flood Component

FINAL HRS

Likelihood of Release

Observed Release or Potential to Release

By Overland Flow
Containment
Runoff
Distance to Surface
Water
By Flood

Containment Flood Frequency

Drinking Water Threat

Waste Characteristics
Toxicity/Persistence
Hazardous Waste Quantity

Targets
Nearest Intake
Population
Resources

Human Food Chain Threat

X

Waste Characteristics
Toxicity/Persistence/
Bioaccumulation
Hazardous Waste Quantity

Targets
Food-Chain Individual
Population

Environmental Threat

Waste Characteristics
Ecosystem Toxicity/
Persistence/Bioaccumulation
Hazardous Waste Quantity

Targets
Sensitive Environments

BELLING COSE WAS AND C

EPA is also concerned that many qualities of recreation areas (e.g., uniqueness, attractiveness, value) cannot be readily quantified or measured, which poses significant problems for a screening teel. Therefore, the recreational use threat has been removed from the final rule. Instead, factors related to recreational use are being included in the assessment of resource factors in the air, surface water, and ground water migration pathways. (See the discussion of resources factors above and §§ 3.3.3, 4.1.2.3.3, 4.2.2.3.3, and 6.2.3 of the rule.) Recreational use is also a major component of the evaluation of the attractiveness/accessibility factor in the soil exposure pathway (see § 5.2.1.1 of the rule).

Human food chain. SARA requires that EPA consider "the damage to natural resources which may affect the human food chain " "" Accordingly, the surface water migration pathway of the proposed rule included evaluation of threats to human health via the aquatic food chain.

A number of commenters suggested that terrestrial food chain threats should also be evaluated because most of the food eaten in the United States originates on land, and the terrestrial human food chain is, therefore, more important than the aquatic human food chain. Commenters specifically stated that the HRS should account for human food chain threats involving imigated crops, livestock, and game animals. One commenter stated that the SARA mandate would not be fulfilled if only aquatic human food chain threats were evaluated.

After conducting an investigation into possible methods, EPA determined that it would not be practical to include a separate evaluation of terrestrial human food chain threats in the HRS. The terrestrial food chain is more comp and site-specific and is less understood than the aquatic food chain, and its assessment requires considerably more data. These factors render evaluation of the relative risks associated with the terrestrial human food chain well beyond the capability of a screening system such as the HRS. The final rule, therefore, does not separately evaluate terrestrial human food chain threats. These threats are, however, considered indirectly under the resources target components in the air migration pathway, ground water migration pathway, soil exposure pathway, and drinking water threat portion of the surface water migration pathway.

The proposed rule required the estimation of bioaccumulation potentials for hazardous substances

posing threats viz the human food chain.
One commenter stated that the
estimation of bioaccumulation
potentials requires excessive time and
resources, and that this step should be
dropped from the HRS.

EPA disagrees and considers the bioaccumulation potentials of hazardous substances to be among the most important factors determining the degree of human health threat posed by substances via the human food chain. Substances that do not bloaccumulate pose less of a threat via the human food chain than substances that bioaccumulate, all else being equal-Conversely, substances with high bioaccumulation potentials can pose very significant threats via the human food chain even if they are only moderately toxic, or are present in modest quantities. EPA believes that compiling bioaccumulation potential tables will reduce the effort and resources required to score this factor.

EPA received several comments stating that bioaccumulation potential was not given sufficient weight in the evaluation of human food chain threats. EPA evaluated the use of bioaccumulation potential during the field test and determined that there was considerable uncertainty related to this factor, in part because of major differences in uptake associated with different species in different environments. In addition, bioconcentration values have been computed for only a few species for most substances. In light of this uncertainty, EPA decided that bioaccumulation potential should not be given additional weight in the HRS. In addition, as part of the structural changes discussed in Section III B, the bioaccumulation potential factor was moved from the targets factor category to the waste characteristics factor category so that it is evaluated consistently with the other waste characteristics factors that reflect exposure. As part of these changes, the use of the bioaccumulation potential factor in selecting the substance posing the greatest hazard also has been modified.

The final rule broadens the definition of actual contamination of the human food chain by modifying one criterion and adding a new criterion defining actual contamination. The proposed rule defined a fishery as actually contaminated if (1) the fishery was closed as a result of contamination and a substance for which the fishery was closed had been documented in an observed release from the site, or (2) a tissue sample from a buman food chain organism from the fishery was found to

contain a hazardous substance at a concentration level exceeding the FDAAL for that substance in fish tissue and the substance had been documented in an observed release from the site. In both cases, at least a portion of the fishery must be within the boundaries of the observed release.

Under the final rule, the former criteriun (closed fishery) remains essentially unchanged. The latter criterion (tissue contamination) has been modified: A fishery is considered actually contaminated if the concentration of a hazardous substance in tissue of an essentially sessile benthic human food chain organism from the watershed is at a level that meets the criteria for an observed release from the site and at least a portion of the fishery is within the boundaries of the observed release. A new criterion has also been added: A fishery is considered actually contaminated if a hezardous substance having a bioaccumulation potential factor value of 500 or greater either is present in an observed release established by direct observation or is present in a surface water or sediment sample at a level that meets the criteria for an observed release from the site and at least a portion of the fishery is within the boundaries of the observed release. Only the portion of a fishery within the boundaries of an observed release is considered actually contaminated.

EPA broadened the definition of actually contaminated fisheries on the basis of field test results. With the more narrow definition in the proposed rule, few actually contaminated fisheries were identified because:

- (1) Closed fisheries did not exist at most sites;
- (2) Hazardous substance concentration data from tissues of applicable organisms were available for only a small portion of fisheries; and

(3) FDAALs exist for only a relatively small number of hazardous substances.

The final rule also introduces two levels of actually contaminated fisheries or portions of fisheries:

Level I: Applicable when concentrations of site-related hazardous substances meeting the criteria for actual contamination of the fishery equal or exceed the benchmark concentration levels established in the final rule based on FDAALs, screening concentrations corresponding to elevated cancer risks, and screening concentrations corresponding to elevated chronic, non-cancer toxicity risks via oral exposures. The final rule allows Level I contamination to be established based on hazardous

substance concentrations in tigrue samples from "organisms other than essentially qualle benthic organisms" (e.g., fish, lobotots, crobs), even though these organisms cannot be used to establish observed releases or actual

Level II: Applicable to all actually conteminated fisheries (or portions of actually operaminated fisheries) not

personny conteminated Scheries) not meeting Level I exterie.

The Smal rule assigns busines feed chain populations associated with Level I concentrations traffiel greater weight than those absociated with Level II concentrations. The final rule also describes the percudure lie detrinising, where applicable, the part of a fishery subject to Level I or a manny subject to Level I
concentrations, the part subject to Level
II concentrations, and/or the part
subject to potential contemination.
EPA societyed several comments
suggesting that, to be consistent with the
other firents, a maximally several

other threats, a maximally exposed individual factor should be incorporated into the human food chain threat. The Agency agrees, and to provide this consistency the final rule incorporates a maximally expressed individual factor (the food chain individual) into the human food chain targets factor category. As with similar factors in other pathrenge and therets, the food chain individual is entigeed points according to the level of con بازو ك Where actual contamination of a fishery is documented, the food chain individual factor is ensigned 50 points for Level ! nd 45 points for Level II concentration Where no actual contamination of a fishery is documented, but there is documentation of an observed release of a hexardons substance having a biooccumulation potential factor value of 500 or greater to a watershed containing a fishery within the target distance limit, the food chain individual is assigned a value of 20 paints. Where

· there are no observed releases to surface water or no observed release of a bezardous substance with a bioaccumulation potential factor value of 500 or greater, but a fishery is present (i.e., there is a potentially contain fishery) within the tinget distance limit, the feed chain individual is assigned points ranging from 0 to 20, depending on the dilution weight assigned to the associated surface water body.

The proposed rule estimated he food chain production of actually contaminated or potentially contaminated or potentially contaminated fisheries based on horvest lets or stecking data for those fisheries, f avidable. Where such data were not र्वे दश sveilable, production estimates were based on productivity of the surface water body or the estimated standing crop of equatic blots in the fisheries. The proposed rule included a table of standing crop default values for estimation home. estimoting human food chain production of the linkery.

EPA received numerous comments to the effect that the standing crop default table was difficult to use, provided several different values for some water bodies and none for others, and provided unreliable data. Several commenters stated that standing cros values are not an appropriate basis for estimating aquatic human food chain production. One commenter pointed out that standing crop estimates do not correlate well with harvest for various water body types. Another commenter stated that estimates of hervest from fish and game officials are preferable to ng crop default values because or crop is a measure of biomass (weight of all adible living organisms in the water body) rather than productivity.

EPA agrees with the commenters. In the final rule, estimates of fishery sman food chain production are based on fish barvest data (including stocking

data) as opposed to standing crop data. When eith specific data are not available, harvest sates are to be estimated based on the average hervest per unit area for the particular water body type winder assessment and the geographic area in which the water geographic mee body is located.

Ground water discharge to surface uter. A number of commenters and field test participants suggested that the IBS should consider the potential impact of ground water discharges to surface water because contaminated nce water promu-md water can be a significant sour manufaction. Pield ificant source of surface water contac test participants noted that some cites have no overland flow routs, but surface water can be contaminated through ground water discharges

EPA agrees and has added a ground water to surface water migration compensat to the surface water signation pathway. Figure 7 shows the structure of this component. The surface structure of this component. The surface water migration pathway, therefore, now includes two components: The overland flow/flood migration component, which rate the structure of the stracture of the structure of the stracture water migration pathway as proposed (except for the changes discussed in this prosmble), and the new ground water to surface water migration compensat. Either or both components may be scared; if both are scored, the surface water migration pathway score is the higher of the two scores. EPA as any augment or the two scores. EPA selected the higher of the two scores rather than combining them because, if scores were combined, the amount of as substances at the site available to migrate via each component would have to be apparticated between the two components. The site-specific data needed to determine the appropriate apportionment are rarely available.

Figure 7

Surface Water Migration Pathway -Ground Water to Surface Water Component¹

FINAL HRS

Likelihood of Release X

Observed Release or Potential to Release Containment Net Precipitation Depth to Aquifer Travel Time

Drinking Water Threat

Waste Characteristics	K	Targets
Toxicity/Mobility/Persistence	:	Nearest Intake
Hazardous Waste Quantity	Population	
	•	Resources

Human Food Chain Threat

Waste Charac	teristics	X	Targets
Toxicity/Mobil	ity/Persistence	: /	Food Chain Individual
Bioaccumulat	ion.		Population
Hazardous Was	te Quantity		-

Environmental Threat

Waste Characteristics X Ecosystem Toxicity/Mobility/	Targets Sensitive Environments
Persistence/Bioaccumulation	•
Hazardous Waste Quantity	

New component.

BILLING CODE \$560-50-C

The ground vester to surface water migration component evaluates three threats: drinking water, busines food chain, and environmental. The ement is scored only if: (1) A portion of the surface water is within ne mile of any source at the site that could release to ground water: (2) there is no discontinuity in the uppermost aquifer between the source and the portion of the surface water within out ale of the source; and (3) the bottom of the surface water is at or below the to of the agains. The target distance limit for the compensat is determined the e way as for the overland flow/ Rood cos sent. For each threat. likelihood of release is based on either observed release or potential to release. An observed release is established if, nd only if, there is an observed rele to the appearant aquifer, while potential to release is based on ground water utiol to release factors, except that only the appearant equifur is idenal (See § 42212)

The bestrikes waste questity factor is scored in the same way it is scored for e everland flow/Sood m component, except that only sources that could release to ground water are considered (see § 4.2.2.2). Texicity, pround water mobility, and surface water persistence are considered in cting the substance potentially ing the greatest hezzed in drinking r fore \$ 4.2.2.1). By considering nd water mobility, the final rule reflects the fraction of a hexarden tance expected to be released from the sources and to migrate through and water to the surface water body. en food chein and environmental threats, bioaccumulation (or ecosystem biseccumulation) potential is also considered in selecting the substance potentially posing the greatest housel (see § 4.2.3.2.1).

The targets factors in this component are evaluated in the same way as targets factors in the evactand flow/flood migration component, except that a diletion-weight adjustment is combined with the surface water dilution weight for populations potentially expected to contamination. The dilution-weight adjustment was added because the HRS assumes that hazardous substances migrate via ground water in all directions from a site. Under this assumption, except in those instances where the surface water body completely surrounds the site, only a portion of the hazardous substances can be assumed to reach the surface water through the ground water. The dilution-weight adjustment accounts for the portion of the hazardous substances

ned to be av lable to migrate to surface water through ground water. The probable point of entry is defined as the shortest straight-line distance, within the squifer boundaries, from the sources at the site to the surface water body. Therefore, the actual targets lared may differ somewhat from targets evaluated in the overland flow/ flood migration component because the two probable points of entry may differ. This appeared might allow evaluation of es, fisheries, and sensitive environments that may be exposed to contentination from a site but are epstresse from the point of overland Sow entry.

N. Soff Exposure Pathway

The ensite exposure pathway, which was added to the HRS in the proposed rais, has been renamed the soil come pathway in the final rule. The pathway was primarily designed to assess the potential threats posed by direct exposure to wastes and contaminated serious materials at a site. It evaluated two threats—the resident population and the negity population. In the proposed sale, ti resident population threat included three types of targets: bligh risk population on a property with observed contamination, all other residents and people attending school or day cure on a property with observed contamination; and textestrial sensitive environments in which there is observed continuination. The nearby population was based on people who live or a stepped school within one sale was a sure sale travel displace and who did not meet the criteria for resident population. Figure 6 summarizes the proposed and final rules.

A number of commenters supported the inclusion of the pathway, but raised insues related by its evaluation. For example, commenters objected to evaluating the waste characteristics factor category solely on toxicity. Three commenters objected to limiting the high risk population to children under seven. Other commenters stated that collecting data on the high risk population would be difficult. A number of commenters questioned how the onsite area and area of commenters would be defined and how accessibility of the site was evaluated.

In response to these comments and to the field test results, EPA has made a number of changes to the soil exposure pathway. The name of the pathway has been changed to be more consistent with terminology used in the Superfund laman health evaluation process.

As suggested by commenters, the final rule limits the area within which bursan targets are evaluated for the resident

population threat to locations within property boundaries and within a distance limit of 200 feet from an area of observed contamination. The 200-foot limit accounts for those situations where the property boundary is very large, and exposure to contaminated sufficial materials is unlikely or infrequent because of the distance of residences, schools, or work places from an area of observed contamination on the same property.

To make the puriousy consistent with the other puriousys and in response to comments, the final sale includes hazardous weste quantity in the waste characteristics factor category and lies it by the factor value for taxicity. New factors, resident individual and nearby individual, have been added to make the pathway consistent with the other pathways. all ---of which essign values for the maximally expand individual (e.g., nearest individual or intake). Population is evaluated using two levels of actual contamination based on health-based contra heachmarks. Separate consideration of the high risk population (children under seven) has been eliminated because the field test indicated that this factor could greatly add to the time and expense of scoring a site yet resulted in little nation among sites. This change also makes the soil exposure pathway more consistent with the other pelimays.

In the nearby population threat, the estardous waste quantity factor in the likelihood of exposure factor category has been renamed "aron of nation" to reflect both the intent of the factor and how it is evaluated. The accessibility/fraquency of use factor has been revised and renamed the "attractiveness/accessibility" factor. The revised factor cuphesizes recreational uses of grass of observed contamination because they are most likely to result in exposures to contrationated surficial systemials. In addition, the weighting of the nearby population relative to the resident dation has been reduced to better reflect the relative levels of exposure for those threats.

A number of commenters questioned whether workers should be counted when evaluating target populations in the soil exposure pathway. One commenter suggested that soil exposure scuting abould "not include activities at facilities that presently are regulated under the Occupational Safety and Health Administration (OSHA)." Other commenters, however, stated that workers should be counted in the target population. One commenter argued that

not counting a facility's work force is inconsistent with other population counting techniques. Another commenter said that workers should be included in the resident population because the proposed method of calculating soil exposure pathway scores can result in inappropriately low scores when onsite workers are exposed to wastes or contaminated soil.

In response to these comments, the Agency investigated statutory, regulatory, and policy conditions that

might restrict the inclusion of workers in the target population fo: the soil exposure pathway. This analysis found no broad statutory or regulatory authority for excluding workers covered by OSHA regulations from consideration as targets in the HRS. Although the definition of a release under CERCLA section 101(22) excludes "any release which results in exposure to persons solely within a workplace " " it only does so for purposes of claims by workers who are already

covered by State worker compensation laws. The legislative history of section 101(22) specifically anticipated that authority under CERCLA might, in appropriate cases, be used to respond to releases within a workplace. Thus, the Agency concludes that there are no broad statutory or regulatory restrictions against consideration of activities at OSHA-regulated facilities.

BILLING CODE 6500-60-M

Figure 8

Soil Exposure Pathway

PROPOSED HRS

Resident Population Threat

Likelihood of Exposure	X	Waste Characteristics	X.	Targets
Observed Contamination		Toxicity		High Risk Population Total Resident Population Terrestrial Sensitive Environments

Nearby Population Threat

Likelihood of Exposure	X	Waste Characteristics	X	Targets
Waste Quantity Accessibility/Frequency of	Use	Toxicity		Population Within 1 Mile

FINAL HRS

Resident Population Threat

Likelihood of Exposure	X	Waste Characteristics	X	Targets
Observed Contamination		Toxicity Hazardous Waste Quantity		Resident Individual Resident Population Workers Resources Terrestrial Sensitive Environments

Nearby Population Threat

Likelihood of Exposure	X	Waste Characteristics	X	Targets
Attractiveness/Accessibility Area of Contamination		Toxicity Hazardous Waste Quantity		Population Within 1 Mile Nearby Individual

The soil exposure pathway is designed to account for exposures and nealth risks resulting from ingestion of contaminated surficial materials. Recause ingestion exposures are comparable for some types of workers and residents, the Agency has decided to include workers in the resident population threat. However, substantial variability in the kinds of workers and work activities at sites (e.g., indoor and outdoor) leads to considerable variability in exposure potential. The Agency believes that determining specific categories or types of workers is beyond the scope of HRS data collection. Thus, workers are assigned target points on a prorated basis: 5 points are assigned for sites with up to 100 workers; 10 points for sites with 101 to 1,000 workers, and 15 points for greater than 1,000 workers. Proceeting workers will reduce the data collection effort. Evaluation of workers is not affected by health-based benchmarks. (See § 5.1.3.3.) Nearby workers are not counted in the nearby population because the Agency considers it unlikely that workers from nearby workplaces would regularly visit contaminated areas outside the property boundary of their workplace during the workday, and because there is no way to estimate accurately the number of workers who might.

O. Air Migration Pathway

The proposed rule made several significant changes to tine air migration pathway in the original HRS. In response to the SARA mandate to consider potential as well as actual releases to sir, the proposed rule included an evaluation of the potential to release. The proposed rule also added a mobility factor to the waste characteristics factor category and an MEI factor to the targets category. Finally, the proposed rule added explicit distance weighting factors for evaluating all factors in the targets category. Figure 9 shows the proposed air migration panisway and the final rule pathway.

The public provided numerous comments on these changes and raised new issues as well. The most significant new issue concerned the structural inconsistency in the treatment of gases and particulates in the proposed air migration pathway. For example, commenters observed that in the potential to release evaluation, it was possible to assign a high containment value to a source with good gas containment and poor particulate containment while assigning high source type and mobility values based on the presence of gaseous hazardons substances. This combination would yield an inappropriately high potential

to release value. This concern was also noted in discussions with field test personnel.

The Agency agrees with these commenters and investigated methods to better reflect the differences between gases and particulates. As a result of these analyses, EPA has made several changes to the final rule in both the likelihood of release and waste characteristics factor categories.

In the likelihood of release factor category, the final rule evaluates source potential to release separately for gases and particulates. Only those sources containing gaseous hazardous substances are evaluated for gas potential to release, and only those sources containing hazardous substances that can be released as particulates are evaluated for particulate potential to release. This change in potential to release structure necessitated other changes in the scoring of potential to release including development of separate gas and particulate source type factors and migration potential factors. The names of these latter factors were also changed to highlight the differences between potential to release "mobility" and waste characteristics "mobility." (See §§ 6.1.2.1.3, 6.1.2.2.3.)

BOLLING CODE 6500-50-M

Figure 9

Air Migration Pathway

PROPOSED HRS

Likelihood of Release X Waste Characteristics X Targets

Observed Release

Œ

Potential to Release

Source Containment Source Type Source Mobility Toxicity/Mobility
Hazardous Waste Quantity

Maximally Exposed Individual

Population Land Use

Sensitive Environments

FINAL HRS

Likelihood of Release X Waste Characteristics X Targets

Observed Release

or

Potential to Release

Toxicity/Mobility

Hazardous Waste Quantity

Nearest Individual

Population Resources

Sensitive Environments

Gas

Gas Containment

Gas Source Type

Gas Migration Potential

Particulate

Particulate Containment Particulate Source Type Particulate Migration

Potential

BELLING CODE SING-09-C

In addition to these changes in the basic structure of the potential to release factors, the final rule includes several additional changes in the source type list, migration potential factors, and containment factors. Based on the experience gained in the field test, EPA added several source types to the source type list. Some of these additions (e.g., surface impoundment (not buried) backfilled): dry) simply clarify classifications that were implied in the proposed source type list. Other additions; such as source types involving biogas release, were considered early in the development of the proposed HRS but were not included originally in the interest of simplicity. Field test experience, however. indicated that their inclusion in the final rule was necessary. Finally, new distinctions within some source types (e.g., the various types of piles) were added partly in response to comments and partly as a result of field test experience. As applicable, source type values were also revised. (See §§ 6.1.21.2 6.1.2.2.2 and Table 8-4.)

The revised gas and particulate migration potential factors are very similar to the proposed likelihood of release gas and particulate mobility factors. Several commenters questioned the need for including dry relative soil volatility in the final gas migration factor. A simplification analysis indicated that dry relative soil volatility was redundant, as it was almost completely determined by vapor pressure. Hence, the final gas migration potential factor includes only vapor pressure and Henry's law constant. The particulate migration potential factor in the final rule is simply the particulate component of the proposed potential to release mobility factor.

The containment factors were also changed as a result of the field test, a review of recent information on covering systems, the examination of air release rate models, and the public comments on the need for simplicity in the final rule. The final list of containmen descriptions eliminated many redundant descriptions and changed others, retaining only those distinctions that are necessary based on type of source. (See §§ 6.1.21.1, 6.1.2.2.1 and Tables 6-3, 6-9.) As discussed in Section III F above. two new mobility factors were developed for the waste characteristics factor category.

Commenters generally supported the concept of distance weighting target factors. However, several disagreed with the approach used to develop the proposed factor values. Some our menters suggested basing the factor

values on long-term meteorology and the size of the site, while others suggested that additional atmosph ric phenomena (e.g., particulate deposition) be reflected in the final values. As a result of these comments, EPA has revised the distance weighting factors used in the final rule to reflect long-term atmospheric phenomena. Analyses indicated that particulate deposition and other similar phenomena as well as site size were not sufficiently significant within four miles of a site to warrant their inclusion in the final factor values. EPA also notes that the distance weighting factor values are now incorporated in the population factor value table. (See § 6.3.2.4 and Table 6-17.1

P. Large Volume Wastes

Mining waste sites. A number of commenters representing mining companies, trade associations, and State and Federal agencies commented on how the proposed HRS would score mining waste sites; commenters representing waste management facilities raised similar issues in regard to their sites. This section summarizes and addresses the major issues addressed by these commenters.

Commenters raised several concerns regarding the appropriate consideration of background levels of metals in documenting direct or indirect releases from mining waste sites. One commenter recommended that in determining direct releases from a mining waste site, EPA should consider the natural characteristics of the site prior to mining and the changes in migration rates resulting from mining. The commenter explained that the concentration of metals in a mining waste pile may be similar to or less than natural concentrations in soil or rocks below and adjacent to the pile. To document indirect releases, the commenter suggested that EPA require collection of detailed information on site geology and hydrological gradients to ensure proper consideration of background levels. Finally, the commenter asserted that although it is appropriate to weight observed releases more heavily than potential releases at sites with synthetic organic hazardous substances, the criteria used to define observed release are not valid at sites with natural sources of metals. Another commenter agreed and suggested that . because of background levels of inorganic elements, the proposed HRS could identify as an observed release concentrations unrelated to mining

EPA recognizes that natural background concentrations of metals in soil or rocks can affect the measured concentration necessary to establish an observed release at a mining waste site. This consideration is reflected in the requirement that concentrations significantly above background be shown to establish an observed release. Moreover, EPA has clarified the observed release criteria in the final rule to explain that they specify minimum differences necessary to establish an observed release by chemical analysis.

Several commenters questioned the treatment of metals in the ground water mobility factor. One commenter stated that the proposed HRS is biased against mining waste sites because it gives greater consideration to the accurate assessment of the mobility of organic substances than to that of naturally occurring metals. The commenter noted that the proposed persistence factor for the surface water migration pathway accounts for the degradation of hazardous substances in the environment through four processes. None of these processes, according to the commenter, applies to metallic elements, which received a default value of 3 (the highest possible score for persistence). Another commenter stated that decreased mobility was considered only for organic compounds, even though inorganic compounds are immobile in some situations.

One commenter stated that adding a metals mobility factor, as EPA's Science Advisory Board (SAB) recommended, would allow the HRS to reflect more accurately the potential for metallic elements to migrate in the aqueous phase. Two commenters were concerned that metals would be assigned a "worst-case" default value for mobility. On the other hand, another commenter stated that consideration of the mobility of metals in the revised HRS would at least partially rectify the bias in the current HRS against high-volume, low-concentration mining wastes.

A number of these commenters appear to have misunderstood the proposed rule. Metals were not automátically assigned the maximum value as a default in the ground water mobility factor, but rather were assigned values based on their coefficient of aqueous migration. The final rule automatically assigns the maximum value for mobility only to metals establishing an observed release by chemical analysis, which is the same way organics and nonmetallic inorganics are evaluated. For metals and metal compounds not establishing an observed release by chemical analysis. mobility is based on water solubility and distribution coefficient (Ka), the same as for organics and nonmetalliinorgenics. If none of the hexardous substances (including metals, organics, and nonnetallic inorgenics) eligible to be evaluated for the site can be assigned a mobility factor value based on available data. § 3.2.1.2 of the final rule assigns a mobility factor value of 0.002 for all of the hexardous substances. This value was selected based on a review of the range of mobility factor values assigned to those hazardous substances (including metals) for which data were available for assigning mobility factor value. The value of 0.002 is clearly not a worst-case default (which would be 1.00.

EPA believes that the persistence factor is not biased against metals. Elemental metals do not degrade and, therefore, should receive higher scores for persistence than other substances subject to degrade the mecasses.

subject to degradation processes.

One commenter claimed that the soil exposure pathway is likely to bies the HRS account of mining waste sites toward higher values because such sites cantain large volumes of waste covering large surface areas, and because of geographic facture, those large areas are solden account against direct public access. In addition, according to the commenter, the public may be attracted to mining waste sites. The commenter suggested that the soil exposure pathway income there is access to mining waste there is access to

mining wests sites.

EPA does not agree that the soil exposure pathway is biased against mining wests sites. The pathway evolutes exposures of people via contact with surficial hezardous substances. The Agency believes that, all else being equal, large contaminated surface areas with public access, including these associated with mining wests sites, should receive higher scores for the soil exposure pathway than smaller sites with more restricted access. But sites with large contaminated surface areas are unlikely to be assigned high scores except when they are near residential areas or include a listed sansitive environment. As some commenters representing mining-related activities have noted in the past, most mines are located some distance from inhabited areas.

Three commenters stated that the original FRS was biased against sites such as unining waste sites that are characterized by high volumes of waste with relatively low concentrations of toxic constituents. Two of these commenters suggested that mining wastes would be appropriate for lazzardous constituent quantity determination because such wastes are relatively homogeneous (compared to

other wastes) and, therefore, have fairly consistent concentrations. One of these two commenters also stated that the hazardous waste quantity factor equations in Table 2–14 of the proposed role should be revised to be less conservative. The remaining commenter suggested that the proposed HRS was still blased against mining waste sites because they are still scored based on the quantity of waste rather than on the concentration of the waste at the point of exposure.

EPA does not agree that the HRS is biased against high-volume, lowconcentration waste sites. The final rule incorporates concentration data in three factors: (1) Likelihood of release (concentration data can be used for establishing an observed release); (2) bazardous waste quantity (concentration data, if available and adequate, can be used for calculating hazardous constituent quantity); and (3) targets (concentrations of hazardous substances present in drinking water wells or at other exposure points can be used to determine weightings for nearest individuals (or wells or intakes). opulations, and sensitive environ factors). EPA has not explicitly required concentration data for all sites because of the substantial costs for obtaining these data and the very high degree of uncertainty associated with data collected during Sis. EPA requested that the SAB review

EPA requested that the SAB review issues related to large-volume waste sites before the NPRM was published. The SAB final report is available in the CERCLA docket. Two commenters stated that the Agency did not adequately consider the SAB's recommendations for revising the HRS, specifically those concerning the use of inchility data.

inobility data.

The SAB, in its review of the original HRS, examined whether large-volume waste sites (e.g., mining waste sites) had been treated differently than other waste sites and concluded that insufficient data were presented to demonstrate that the original HRS was biased against usining waste sites. However, the SAB noted that the original HRS had the potential for such a bias, particularly when scoring potential to release, because the original HRS did not consider mobility, concentration of hazardous constituents, and transport. The SAB suggested several possible modifications to improve the application of the HRS to mining waste sites.

Based in part on the SAB suggestions, EPA proposed several changes to the overall scotting process to make the HRS more accurately reflect risks associated with mining waste sites, notably, addition of a mobility factor to the air

and ground water migration pathways, changes in the persistence factor, incorporation of a tiered hazardous waste quantity factor that can account for weste concentration date, and addition of health beand benchmarks for evaluating population. As explained in the NPRM, determining speciation of metals and pH, as the SAB had suggested, is not feasible given the temporal and spatial variations at hazardous waste sites and the limitations on SI date collection. Moreover, determining speciation is not feasible for most substances given EPA's cursuant analytical procedures; requiring speciation analyses would add substantially to the cost of data collection.

Two commenters stated that the proposed HRS can significantly overestimate risks associated with mining waste sites that consist of high-volume, low-concentration wastes. One of these commenters recommended a "preliminary evaluation system" to more accurately reflect the actual risks associated with such sites and remove any bies in the HRS relative to other types of sites. This commenter also suggested that in proposing the HRS revisions, HPA had ignored the results of its own studies under RCRA sections 3001 and 5002, which the commenter believed to be more focused efforts to quantify risks from mining waste sites than the HRS revisions.

EPA does not believe that a separate "preliminary evaluation system" for scoring mining waste sites would be appropriate. A single HRS can be upplied uniformly to all sites, allowing the Agency to evaluate sites relative to each other with respect to actual and potential bazards. The Agency examined the BCRA studies cited by the commenter before proposing HRS revisions. Those studies, which focus on the management of wastes at active facilities, concluded that many special study waste sites (e.g., mining) do not present very high risks, while others may present substantial risks. EPA believes that the conclusions of these studies and the Agency's subsequent regulatory determinations (i.e., not to regulatory determinations (i.e., not to regulate most mining wastes under RCRA Subtitle C) are not inconsistent with a determination that some mining waste releases can require Superfund response actions. Furthermore, the HRS is designed so that it can be applied to closed and abandoned sites as well as active sites.

Other large volume waste sites. Several commenters suggested that the proposed HRS did not meet CERCLA section 125 requirements for sites involving fossil fuel combustion wastes. These commenters generally agreed that section 125 requires EPA to consider the quantity and concentration of hazardous constituents in fossil fuel combustion wastes and that the proposed HRS had not adequately addressed this requirement.

One commenter supported the Agency's proposal to allow consideration of concentration data when such data are available. Three commenters stated that the proposed HRS would often assign fossil fuel combustion waste sites high scores in part because of the worst-case assumptions or "default values" for certain factors (i.e., hazardous waste quantity, toxicity, target populations) The commenters claimed that fossil fuel combustion waste sites receive high scores merely because of the large quantity of waste, although this waste presents no significant adverse environmental effects, and that these high scores are inconsistent with EPA's findings in the RCRA section 8002 study. One of the three commenters suggested that the proposed HRS retained certain deficiencies of the original HRS, such as assuming that all hazardous substances in the waste consist of the single most toxic constituent in the waste.

EPA does not believe that the approach taken in the final rule creates a bias against fossil fuel combustion wastes. Partly because concentration data are considered in the final rule. fossil fuel combustion waste sites are not expected to score disproportionately high when compared with other types of sites. The HRS assumes that it is not possible to determine in a consistent manner the relative contribution to risk of all hazardous substances found at sites. Given this assumption, EPA has determined that basing the toxicity of the combination of substances at a site on the toxicity of the substance posing the greatest hazard is a reasonable and eppropriately conservative approach. In many cases, the substance posing the greatest hazard is not several orders of magnitude more toxic than other liazardous substances at the site. Therefore, the effect of this approach on the toxicity factor value-which is evaluated in one order of magnitude scoring categories—is not as great as some commenters have suggested (see also section III D). In addition, as noted above, worst-case defaults are not assigned for mobility: population factors have no default values.

Two commenters suggested that because CERCLA section 125 contains no statutory deadlines, EPA should take as much time as necessary to adequately respond. These commenters recommended that EPA extend the tiered approach of the hazardous waste quantity factor to other factors to take advantage of the extensive data on fossil fuel combustion wastes generated by the electric utility industry.

The Agency does not agree that the tiered approach used in the hazardous waste quantity factor should be extended to other factors for fossil fuel combustion waste sites (see also section III K). EPA believes that creating a separate HRS to score certain types of sites would not allow the Agency to provide a uniform measure of relative risk at a wide variety of sites, as Congress intended.

One commenter recommended that EPA consider using fate and transport models currently under development to incorporate quantitative representations of specific processes and mechanisms into the HRS. EPA carefully examined this possibility and concluded that although the use of fate and transport models could conceivably increase the accuracy of the HRS for some pathways. collection of the required site-specific data would be far too complex and costly. Fate and transport models are appropriate for a comprehensive risk assessment, but not for a screening tool such as the HRS. In addition, EPA's review suggested that it would be more difficult to achieve consistent results among users of such models than with the HRS. EPA points out that it used fate and transport models to develop the distance weighting factors used in the HRS target calculations, and also that the HRS incorporates several hazardons substance parameters (e.g., mobility) and site parameters (e.g., travel time) that are components of fate and transport models.

Two commenters expressed concern that the proposed HRS fails to account for the leachability of hazardous constituents as required by CERCLA section 125. According to the commenters, some hazardous constituents pose no risk via ground water because they will never be released to that medium. Thus, even if hazardous waste quantity and concentration are considered adequately, hazardous waste quantity scores for fossil fuel combustion sites will be erroneously high unless leachability is considered as well.

EPA examined the availability of leachate data and the feasibility of using such data for calculating hazardous substance quantity for all types of sources and wastes. The Agency decided against using leachate concentrations because:

- Leachate data are not available for all sources and wastes, and available leachate data on high-volume wastes and some landfills have limited applicability for estimating the quantity of leachable hazardous substances;
- Leachate data derived from lab studies are limited and do not realistically represent the universe of field conditions such as heterogeneity of wastes, chemistry of leachate, and density and pore volume of disposed wastes: and

 Any method for using leachate data could not be consistently or uniformly applied to all sites.

EPA also examined the feasibility of developing site-specific leachate data for estimating leachable hazardous substance quantity for the ground water migration pathway. EPA decided against this option because reliable estimation of leachable hazardous substance quantity requires comprehensive sampling of site-specific heterogeneous waste, which would be prohibitively expensive and not feasible. In some cases, such sampling would be technically unleasible and unsafe.

EPA evaluated alternatives for developing a surrogate for estimating leachable hazardous substance quantity. The Agency found that adding the mobility factor to the ground water migration pathway, based both on solubilities and distribution coefficients (K,s) of hazardous substances, and multiplying it by the hazardous waste quantity factor would be a feasible alternative for approximating the fraction of hazardous substance quantity expected to be released to ground water.

Q. Consideration of Removal Actions (Current Versus Initial Conditions)

The criginal HRS based the evaluation of factors on initial conditions. In the preamble to the proposed rule, EPA specifically requested comments on whether sites should be scored on the basis of initia! or current conditions. The principal question is whether the effect of response actions, such as the removal of some quantity of the waste, should be considered when sites are scored. Initial conditions are defined by the timing of the response action; that is, initial conditions are the conditions that existed prior to any response action. For sites where no response action has occurred, initial and current conditions are the same for evaluating sites.

Of the 25 commenters responding to this issue, 15—including all industry commenters—supported scoring on current conditions. In the preamble of the proposed rale, EPA presented two approaches for considering response actions in HRS access: [1] Consider these actions only for those pathways and factors for which they are most appropriate; and [2] consider these actions in all pathways, but make exceptions at sites where initial conditions more accurately reflect risk

conditions more accurately reflect risks.

These who stated a preference fevered the second, specifying that the exceptions should be clearly defined in the final rule. These commenters stated that seering all pathways on current conditions would encourage responsible parties to clean up sites quickly. They reasoned that if cleanups are delayed, the threat of neigration of the hazardous substances increases; therefore, scoring on current conditions is consistent with the intent of CERCLA because it encourages rapid remedial action. One community said that scoring on initial conditions made little sense when, as a result of the cleanup, the level of residual contamination was below the level required by CERCLA.

Several proponents of scoring on current conditions stated that EPA's concern that responsible parties would clean up sites just enough to avoid being listed on the NFL was unfounded. They argued that the proposed scoring system is too complicated to manipulate, and that predicting the effect of partial cleanups on the final score would be difficult. Others suggested that where contamination remains, sampling during an SI will discover it.

Ten commenters did not fully support sceeing on current conditions. Only one ed any consideration of current ditions. Several com supported scoring the soil exposure and air migration pathways on current conditions. Others stated that response actions should be considered only when one are conducted under Federal or State direction, or when the action titutes a complete cleanup. Several added that State actions should not be considered because it would penalize States with active remedial programs. One commenter suggested scoring sites on both current and initial conditions; if the response action had addressed all hazards, then the current conditions score should be used.

Based on public comment, EPA has decided to change its policy on consideration of removal actions. The Agency agrees that consideration of such actions in HRS scores is likely to increase incentives for rapid actions by responsible parties, reducing risks to the public and allowing for more cost effective expenditure of the Fund. In making this decision, EPA tried to balance the besefits of considering

removal actions in HRS scores (e.g., increased incentive for rapid actions) while also ensuring that the HRS score reflects any continuing risks at sites where contamination occurred prior to any response action.

Therefore, EPA will calculate waste nantities based on current conditions. However, EPA believes the accuracy of this approach depends on being able to determine with reasonable confidence the quantity of hazardous constituents naising in sources at the site and the santity released into the environment. As a consequence, where the Agency does not have sufficient information to estimate the quantity of hazardous constituents remaining in the sources at the site and in the associated releases, a minimum factor value may be assigned to the hazardous waste quantity factor value. Thus, removal actions may not reduce waste quantity factor values unless the quantity of hazardous constituents remaining in sources and in releases can be estimated with reasonable confidence.

In addition to providing incentives for early response, this approach also provides incentives for potentially responsible parties to ascertain the extent of the remaining contamination at sites. Potentially responsible parties dertaking removal actions will have the primary responsibility for collecting sy data meeded to support a determination of the quantity of bazardous constituents remaining. EPA expects responsible parties may need to conduct sampling and analyses to determine the extent of hazardous substance migration in soils and other media in order to estimate with reasonable confidence the quantity of hazardous constituents remaining.

EPA decided not to limit the consideration of response actions to certain pathways (e.g., the soil exposure pathway) because this would overstate the risk at sites where removal of wastes has eliminated threats in all pathways. Moreover, a more limited approach to consideration of response actions would provide less incentive for rapid .esponse action.

EPA will evaluate a site based on current conditions provided that response actions actually have removed wastes from the site for proper disposal or destruction in a facility permitted under the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), or by the Nuclear Regulatory Commission. HRS scoring will not consider the effects of responses that do not reduce waste quantities such as providing alternate drinking water supplies to populations with drinking water supplies

contaminated by the site. In such cases, EPA believes that the initial targets factor should be used to reflect the adverse impacts caused by contamination of drinking water supplies: otherwise, a contaminated aquifer could be artificially shielded from further remediation. This decision is consistent with SARA section 118(a). which requires that EPA give high priority to sites where contamination from the site results in closed drinking water wells. Similarly, if residents are relocated or if a school is closed because of contamination due to the site, EPA will consider the initial targets in accring the site.

As noted in the proposed rule preamble, EPA would only consider removals conducted prior to an SI. EPA believes that the SI is the appropriate time to evaluate conditions, because it is the source of most of the data used to score a site. Because response action at sites may be an ongoing process, it would be burdensoure to recalculate scores continually to reflect such actions.

In response to commenters, EPA also considered whether response actions should be considered in HRS scores only if they are performed under a State or EPA order. EPA decided not to choose this approach for two reasons. First, it would diminish the incentive for an expeditious response at the site if a signed order were required. Second, because a response action must be considered before the SI to be considered in the HRS score, there would be little information on site conditions upon which this order could be based.

EPA has also decided not to differentiate between response actions initiated by States and those conducted by other parties. The Agency believes this approach will help ensure nt application of the HRS by g situations where two similar avoiding site sites are scored using different sets of rales. Moreover, although the Agency is sympathetic to concerns about disincentives to States for initiating actions, it believes that such cases will be rare. Many State (and Federal) removal actions are interim measures designed to stabilize conditions at the site. Given the more limited definition of response action noted above (e.g., removal of waste from the site for disposal or destruction in a RCRApermitted facility), many actions conducted by States would not be considered in HRS scoring. In addition, in many cases, State and Federal removal actions are undertaken after an SI has been conducted. As noted above.

EPA will only consider removals conducted before the SI in the HRS score.

R. Cutoff Score

In the NPRM preamble, EPA proposed that the cutoff score for the revised HRS be functionally equivalent to the current cutoff score of 28.5. The Agency also requested comment on three proposed options for determining functional equivalence:

 Option 1: Score sites using both the original and final rule, then use statistical analysis to determine what revised HRS score best corresponds to

 Option 2: Choose a score that would result in an NPL of the same size as the NPL that would be created by using the original HRS; and

 Option 3: Identify the risk level that would correspond to 28.5 in the original HRS and then determine what revised HRS score corresponds to that risk level.

Some commenters stated that there cannot be a functional equivalence if the revisions have any meaning. They argued that if the revisions meet the statutory mandate to make the HRS more accurate, the scores should be different and, therefore, cannot be related. Several commenters supported the use of a functional equivalent, but were divided about which option should be used. One commenter stated that the 28.5 score should be evaluated to determine whether it reflected minimum risk levels. If it did, the commenter suggested that a functional equivalent would be appropriate and should be determined using equivalent risk levels (option 3), but also with an eye toward keeping the NPL to a manageable size (option 2).

Commenters not supporting the use of a functional equivalent suggested a variety of alternative approaches,

 Establish the cutoff score based on risk, without regard to the current cutoff level or a functional equivalent;

· Leave the score at 28.5;

Propose a new cutoff score and a description of methodology in a public netice with a 60-day public comment

- Lower the cutoff score to provide an incentive to responsible parties to undertake remedial efforts and make it possible for sites where a removal action has taken place to make the NPL, thus reducing the controversy over whether to score sites based on current conditions;
- Raise the cutoff score by at least 20 points:
- Eliminate the present cutoff score by creating categories of sites instead of

individual ranks as a means of prioritizing NPL sites;

 Amend the NPL armually to include only those sites that deserve priority attention (e.g., orphaned sites) and are likely to receive Superfund financing; or

 Rank all sites showing any degree of public health and/or environmental risk on a relative scale and perform remedial activities based on available funding.

In addition, four commenters felt that the cutoff score for the final rule should not be fixed until the technical merits and potential scores of representative sites are tested and compared using both the current and proposed HRS. Further, one commenter noted that the field test did not indicate the relationship between the revised HRS score for a given site and the current score; another added that until this equivalency issue is clarified, meaningful comment on any proposed revisions cannot be made.

Based on an analysis of 110 test sites. EPA has decided not to change the cutoff score at this time. This conclusion was reached after applying all three approaches to setting a cutoff score that would be functionally equivalent to 28.5. In its analysis, the Agency scored field test sites with both the original and revised HRS. The data from these test sites show that few sites score in the range of 25 to 30 with the revised HRS model, The Agency believes that this range may represent a breakpoint in the distribution of site scores and that the sites scoring above the range of 25-30 are clearly the types of sites that the Agency should capture with a screening model. Because the analysis did not point to a single number as the appropriate cutoff, the Agency has decided to continue to employ 28.5 as a management tool for identifying sites that are candidates for the National Priorities List.

EPA believes that the cutoff score has been, and should continue to be, a mechanism that allows it to make objective decisions on national priorities. Because the HRS is intended to be a screening system, the Agency has never attached significance to the cutoff score as an indicator of a specific level of risk from a site, nor has the Agency intended the cutoff to reflect a point below which no risk was present. The score of 28.5 is not meant to imply that risky and non-risky sites can be precisely distinguished. Nevertheless, the cutoff score has been a useful screening tool that has allowed the Agency to set priorities and to move forward with studying and, where appropriate, cleaning up hazardous

waste sites. The vast majority of sites scoring above 28.5 in the past have been shown to present risks. EPA believes that a cutoff score of 28.5 will continue to serve this crucial function.

IV. Section-by-Section Analysis of Rule Changes

Besides the changes discussed above. EPA has made substantial editorial revisions in the rule being adopted today. Source characterization is discussed in section 2 of the final rule. along with factors that are evaluated in each pathway. These factors include hazardous waste quantity, toxicity, and evaluation of targets based on benchmarks. The order of presentation of the pathways has been changed to ground water, surface water, soil exposure, and air. Following the four sections describing the pathways, a section has been added explaining how to evaluate sites that have radionuclides either as the only hazardous substances at the site or in combination with other hazardous substances.

In general, descriptive text that provided background information has been removed as have references and data sources; the sections have been rewritten to make the rule easier to read and to apply. The figures presenting overviews of the pathways and the scoring sheets have been revised throughout to reflect changes in the rule and assigned values.

This section describes, for each section of the rule and each table, the specific substantive changes; editorial changes that do not affect the content of the rule are not generally noted.

Section 1 Introduction

The text explaining the background of the HRS and describing the rule has been removed. Definitions of a number of additional terms used in the rule have been added for clarity. The definition of "hazardous substance" has been revised for clarification. The definition of "site" has been clarified and now indicates that the area between sources may also be considered part of the site: The definition of "source" has been revised to explain that those volumes of air. ground water, surface water, or surface water sediments that become contaminated by migration of hazardous substances are not considered a source, except contaminated ground water plumes or contaminated surface water sediments may be considered a source if they cannot be attributed to an identified source. In addition, the definition of source now includes soils contaminated by migration of hazardous substances.

Under the original HRS, the Agency took the approach that all feasible efforts should be made to identify sources before listing a site on the NPL. If, after an appropriate effort has failed to identify a source, the Agescy believed that the contamination was likely to have originated at the type of source that would be addressed under Superfund, such sites were listed. Subsequent investigations after listing have generally identified a specific source. In some cases, RPA has not listed contaminated media without clearly identified sources because it appeared the source of polluties not be addressed by Superfund hirow soits programs; an examp le of such a source ald be extensive, low-level contamination of surface water sodiments caused by pesticide applications. EPA has found this approach to be generally workable and will continue to evaluate, on a case-bye basis, whether sites with no identified sources should be listed

Where costaminated madin with no identified senses exist, the final rule generally assigns a househous waste quantit factor value to such contemination, with the value deposaling on vibriber there are any targets subject to Level I or Level II concentrations. For conteminated sediments in the surface water sejention polivery, if there is a clearly defined disaction of flow, target distances are measured from the point of observed sediment contemination that is forthest upstream. For ground water planes and for conteminated addinants where these is no clear direction of flow, the center of the observed ground water or sediment contemination is used for the purpose of measuring target distance limits.

Section 2 Evaluations Common to Makiple Pathways

This section covers factors and evaluations common to multiple pathways. The major changes to these factors include: observed release criteria have been revised: the texicity factor has been changed to a linear rather than a log scale; scales for hazardous waste quantity have been made linear and expanded, and the hazardous waste quantity minimum value has been changed: the weste characteristics factor category score is now obtained by multiplying the factor values and using a able to as **pa the final score: use** of benchmarks has been extended to all pathways and to the nearest individual (well/intake) factor, and the methods for comparisons to beache: rks have been changed as have the benchmarks used. The purpose of this part is to make the rule less repetitions by presenting full explanations of the evaluation of certain factors only once rather than in each pathway in which they occur.

Exceptions related to radionuclides are noted throughout the rule and referenced to Section 7.

Section 2.1 Overview. Introduces the pathways and threats included in HRS scoring.

Section 2.1.1 Calculation of HRS site score. Provides the equation used to calculate the final HRS score.

Section 2.1.2 Calculation of pathway score. Indicates, in general, how pathway scores are calculated and includes a sample pathway score sheet [Table 3-1].

Section 2.1.3 Common evaluations. Lists evaluations common to all pathways.

Section 2.2 Characterize sources. Introduces source characterization and references Table 3-2, the new sample source characterization worksheet.

Section 2.2.1 Identify sources. Explains that for the three migration pathways, sources are identified, and for the soil exposure pathway, areas of observed contamination are identified.

Section 2.2.2 Identify hazardous substances associated with a source. Covers information previously provided in the introduction to the waste characteristics factor category.

Section 2.2.3 Identify hazardous substances available to a pathway. Explains which hazardous substances my be considered available to each pathway. For the three migration pathways, the primary limitation on availability of a hazardous substance to a pathway is that the substance must be in a source with a containment factor value, for that pathway, greater than 0: that is, the hazardous substance must be available to migrate from its source to the medium evaluated. For the soil exposure pathway, the primary mitation is that the substance must meet the criteria for observed contamination and, for the nearby threat, it must also be accessible.

Section 2.3 Likelihood of release. Specifies the criteria for establishing an observed release (discussed in section III G of this preumble) and explains that p -tential to release factors are evaluated only when an observed release cannot be documented. Table 2-3, which replaces Table 2-2 in the proposed rule, provides the revised observed release criteria for chemical analyses for the migration pathways. Table 2-3 is also used in establishing observed contamination for the soil exposure pathway.

Section 2.4 Waste characteristics.

Defines the waste characteristics factor category

Section 2.4.1 Selection of substance potentially posing greatest hazard

Explains how to select the substance potentially posing the greatest hazard.

Section 2.4.1.1 Toxicity factor.
Explains how to assign toxicity values.
Changes in the approach to scoring toxicity are discussed in section III D of this preamble. Table 2-4 (proposed rule Table 2-11) has been revised to make the assigned factor values linear rather than logarithmic values; however, the relationship among the values has not changed. A provision to always assign lead (and its compounds) an FIRS toxicity factor value of 10,000 was added as a result of changes since the time of the proposed rule in the way EPA develops chaunic toxicity values for load (i.e., reference doses, in units of intake (mg/kg-day), are no longer developed for lead).

Section 24.1.2 Hazardous substance selection. Lists which factors are combined, in each pathway or threat, to elect the hazarder substance potentially posing the greatest hazard. For each migration pathway, each substance eligible for consideration is evaluated based on the combination of toxicity (human or ecosystem) and/or nobility, persistence, and ionocumulation (or ecosystem bioaccumulation (or ecosystem bioaccumulation) potential. The substances selected for each pathway or threat are those with the highest combined values. For the soil exposure pathway, the substance with the highest toxicity value is selected from among substances that meet the criteria for observed contamination for the threat being evaluated. The use of bioaccumulation in the selection of obstances in the human food chain threat has changed as a result of the structural changes discussed above. In the proposed rule, only substances with the highest bioaccumulation values were evaluated for toxicity/persistence; in the final rule, the substance with the highest combined toxicity/persistence/ nlation value is selected in the san food chain threat of the overland flow/flood migration component. For the ground water to surface water migration component, mobility is also considered. This revised method better reflects the overall threat.

Section 2.4.2 Hozardous waste quantity. Describes how to calculate the hazardous waste quantity factor value, as explained in section III D of this preamble. The explanation has been simplified from that presented in the proposed rule, and a discussion of unallocated sources has been added. A discussion clarifying the method for evaluating hazardous waste quantity in the soil exposure pathway was also added, and clarifying language on this

point was inserted throughout the subsections of § 2.4.2. Table 2-13 from the proposed rule has been eliminated.

Section 2.4.2.1 Source hazardous waste quantity. Details the measures that may be considered in evaluating hazardous waste quantity for a source or area of observed contamination.

Section 2.4.2.1.1 Hazardous constituent quantity. Explains how to assign a value to the hazardous constituent quantity factor. An explanation of the treatment of RCRA hazardous wastes has been added to clarify the scoring of these wastes. Table 2-5, Hazardous Waste Quantity Evaluation Equations (proposed rule Table 2-14), has been revised in several ways. The constant divisor of 10 has been moved from these equations and is now incorporated into the factor values assigned using Table 2-6. Two types of surface impoundments are now listed to ensure that buried surface impoundments are treated appropriately. The term "tanks" has been added to containers other than drums to clarify how tanks should be 🕆 evaluated. Also, equations for calculating hazardous waste quantity bused on area have been revised based on a study of waste sites. The study indicated that new depth assumptions should be used for some sources; the land treatment equation was revised based on data from the same study about typical loading rates in land treatment operations.

Section 24.2.1.2 Hazardous wastestream quantity. Explains how to assign a value for hazardous wastestream quantity based on the mass of the wastestream. An explanation of the treatment of RCRA hazardous wastes has been added to clarify the scoring of these wastes.

Section 2.42.13 Volume. Explains how to assign a value for source volume. Section 2.4.2.1.4 Area. Explains how

to assign a value for source area.

Section 2.4.2.1.5 Calculation of
source hazardous waste quantity value.

Explains how to assign a value to source
hazardous waste greatity.

hazardous waste quantity.

Section 24.22 Calculation of hazardous waste quantity factor value. Explains how to assign a factor value to hazardous waste quantity using Table 2-6. The values in Table 2-6 include several changes. The cap applied to the factor value (i.e., the lowest hazardous waste quantity value required to assign the maximum factor value) has been increased to reflect more accurately the range of hazardous substance quantities found at waste sites. The cap is set based on the maximum quantity found at current NPL sites. Rather than being assigned a maximum of 100, as in the

proposed rule, the assigned factor values range to 1,000,000. Each factor value less than the cap is assigned for quantities that range across two orders of magnitude. The two-order-ofmagnitude ranges reflect the uncertainty in estimates of both quantity and concentration of the hazardous substances in sources and associated releases as well as uncertainty in identifying all sources and associated releases. Using the ranges also simplifies documentation require Non-zero values below 1 are rounded to 1 to ensure that sites with small amounts of hazardous substances will receive a non-zero score for waste characteristics. When hazardous constituent quantity data are incomplete, the minimum hazardous waste quantity factor value is 10, except for: (1) Migration pathways that have any target subject to Level I or II concentrations; and (2) migration pathways where there has been a removal action and the hazardous waste quantity factor value would be 100 or greater without consideration of the removal action. In these cases, the minimum hazardous waste quantity factor value has been changed to 100 (see sections III C and III Q above for further discussion of the new minimum

Section 24.3 Waste characteristics factor category value. Explains how to assign a value to the waste characteristics factor category. As discussed above, the final waste characteristics factor value is capped at 100 (1,000 with bioaccumulation potential). Values are assigned by placing the product of the waste characteristics factors into ranges of one order of magnitude, to a cap of 10⁸ (10¹² if bioaccumulation potential is considered).

Section 24.3.1 Factor category value. Explains how to use Table 2-7 to assign a value to waste characteristics when bioaccumulation (or ecosystem bioaccumulation) potential is not considered.

Section 2.4.3.2 Factor category value, considering bioaccumulation potential. Explains how to use Table 2-7 to assign a value to waste characteristics when bioaccumulation (or ecosystem bioaccumulation) potential is considered.

Section 2.5 Targets. Explains how targets factors are evaluated. This approach generally involves three levels of evaluation (Level I, Level II, and Potential) and the use of media-specific concentration benchmarks, as discussed in section III H of this preamble. Level III has been dropped; use of benchmarks has been extended to all pathways and

to factors that assign values to the nearest individual (well/intake). Also discusses assigning level based on direct observation and describes when tissue samples that do not establish actual contamination may be used in comparisons to benchmarks.

Section 2.5.1 Determination of level of actual contamination at a sampling location. Explains the approach used for evaluating the level of actual contamination at a sampling location; changes have been made to allow the level of actual contamination in the level of actual contamination in the human food chain threat to be based on tissue samples from aquatic food chain organisms that cannot be used to establish an observed release.

Section 2.5.2 Comparison to benchmarks. Lists benchmarks and explains how to determine whether benchmarks have been equalled or exceeded (see section III H of this preamble); changes have been made to allow the level of actual contamination in the human food chain threat to be based on tissue samples from aquatic food chain organisms that cannot be used to establish an observed release.

Section 3 Ground Water Migration Pathway

The ground water migration pathway evaluates threats resulting from releases or potential releases of hazardous substances to aquifers. The major changes specific only to this pathway include replacement of the depth to aquifer/hydraulic conductivity and sorptive capacity factors with travel time and depth to aquifer factors; a revised approach for assigning mobility values; removal of the ground water use factors and their replacement by a resources factor, evaluation of the nearest well factor based on benchmarks; and revisions to scoring of sites having both karst and non-karst aquifers present.

Section 3.0 Ground Water Migration Pathway. Descriptive text has been removed. Figure 3-1 has been revised to reflect revisions to the factors evaluated, and Table 3-1 has been revised to reflect the new factor category values throughout.

Section 3.0.1 General considerations. The title has been changed.

Section 3.0.1.1 Ground water target distance limit. An explanation of the treatment of contaminated ground water plumes with no identified source has been added. For these plumes, measurement of the target distance limit begins at the center of the area of observed ground water contamination:

the center is detectained based on available data.

Section 2012 Aguifer boundaries.
Descriptive text has been removed.
Section 20121 Aguifer

Section 3.0.1.2.1 Apolfor intercummentions: Descriptive text has been namewed as have ecomples of information useful for identifying equifor intercummentions.

Section 2.0.1.2.2 Aguifur discontinuities. Descriptive text has been named.

Section 1813 Karst equifor.
Descriptive text has been removed, and references to factors have been revised to reflect changes in factors. Text was added to clarify that knext equifors underlying any portion of the sources at a site one given special consideration.

Section 3.1 Likelihood of release.

Descriptive text has been somewed.
Section 8.1.1 Observed release.
Description of the extents for establishing an observed release has been swited as discussed in Section III.
G of this presemble.

Section 2.1.2 Potential to release.
Test has been revised to reflect changes in the factors evaluated and to clarify that kinet equilers underlying any portion of the sources at a site are given special consideration in evaluating

opth to squifer and travel time. Section 3.1.2.1 Containment. Explanatory text has been removed an the ground water containment table is seed. Only sources that meet the minimum size requirement (i.e., that have a source hazardous weste quantity have a source removement was a year value of 0.5 or higher) are used in assigning containment factor values. This requirement has been added to This see ere that very small, uncontained sources do not unduly influence the score. For example, a site might have a large, but highly contained source and a very small, uncontained source; without a minimum size requirement, potential to release could be assigned the all, uncontained source; with n value bosed on the very sur source, which could overestimete the potential hexard posed by the site. If no source mosts the p عينه حص sirement, the highest ground water containment incher value assigned to the sources at the site is used as the factor value. Table 3-3-Containment Factor es for Ground Water Migratice Pathway, has been simplified by combining sensitive. combining repetitions items and has been moved from an attachment to the osed rule into the body of the rule.

Section 3.1.2.2 Not procipitation. A new map has been added as Figure 3-2 to assign not procipitation factor values. The equation for calculating mouthly potential evapotranspiration was clarified. Descriptive text has been removed.

Section 2.1.2.3 Depth to aquifer. As described in section III L of this preamble, the depth to aquifer factor has replaced the surptive capacity factor and is no longer combined in a matrix with hydraulic conductivity for scaring. Table 3-5 is new and provides the factor values. The depth to aquifer factor reflects the geochemical retardation capacity of the subsurface materials, which generally increases as the depth increases. Depth to aquifer factor values are essigned to three depth ranges. Clarifying language was added related to keep aquifers.

Section 2.1.2.6 Travel time. As discussed in section III L of this presemble, this factor replaces the depth to aquifur/hydrantic conductivity factor and is bused on the least conductive layer(s) rather than on the conductive layer(s) rather than on the conductive of all layers between the hazardous substances and the aquifur. Table 3-7 has been revised to reflect these changes. Table 3-5 from the proposed rule has been remembered as Table 3-6. Text on how to obtain information to score this factor has been removed. Clarifying language was added related to knest aquifurs.

Section 2.1.2.5 Calculation of potential to release factor value. Text has been revised to reflect new factor name.

Section 3.1.3 Calculation of likelihood of release factor cotegory value. New maximum value of 550 based on observed release has been added.

Section 3.2 Waste characteristics.

Descriptive text has been removed.

Section 3.2.1 Taxicity/mobility.

Descriptive text has been removed.

Section 3.2.1.1 Taxicity. References
§ 2.4.1.1.

Section 3.2.1.2 Mobility. As liscussed in sections M P and M P of his preemble, the method for assign ty values to bazardous substances has been revised. Table 3-6 has been sevised. Mobility values are now linear or their categorical place holders må and are assigned in a matrix combining water solubility and distribution coefficients. Mobility values may now vary by aquifer for a specific basardous substance. The maximum mobility value is no longer essigned based on observed release by direct observation. A factor value of 0 is no longer assigned for mobility, as had been the case under the posed rule, where categorical placeolder values were used; because mobility is now multiplied by toxicity and hazardous waste quantity, assigning a 6 value would result in a pathway score of 0. This result could understate the risk posed by a site with a large volume of highly tox c hazardous

substances with low mobility.
Purthermore, given the uncertainties about estimates of mobility in ground water and their applicability in site-specific situations, EPA determined that a 0 value should not be assigned to the mobility factor under any conditions.

Section 3.2.1.3 Calculation of testicity/mobility factor value. Text has been simplified. Table 3-0 (proposed rule Table 3-10), the metric for assigning factor values, has been sevised to reflect the linear nature of the assigned values. Values for a specific hexacolous substance may now vary by aquifer.

Section 3.2.2 Hancedous weste panelity. References § 2.4.2.

Section 3.2.3 Calculation of waste characteristics factor category value. Text has been revised to indicate the multiplication of the factors, the new maximum value, and the table used to assign the factor category value.

"""" 12.3 Targets. Text has been for

Section 3.5 Tanguis. Text has been seviced to reflect the new names for factors. Descriptive text has been supposed rule) has been modified to list the seviced banchmarks in this pathway.

Section 3.3.2 Nonrest well. Title has been changed from meximally exposed individual. Text has been added to explain how to evaluate nearest wells with documented contamination (at Lovel II and II) and these potentially contaminated. Text was added to assign Level II contamination to any drinking water well whose an observed release was established by direct observation. This section also explains how to evaluate wells drawing from karst equifers. Table 3-21 has been renamed and the factor values have been changed. See section III B of this presemble for a discussion of the changes to assigned values for this factor.

Section 3.3.2 Population. As Recursed in section III H, population is realmated using health-based beachmarks for drinking water. For letions potentially exposed. populations potentially exposed, population rangus are used to evaluate the factor. This section explains whom to count for population. Populations served by wells whose water is blended with that from other drinking water sources are to be appartioned based on the well's relative contribution to the stal blended system. The rule includes instructions on the type of data to use when determining relative contributions of wells and intakes. This change is nded to reflect more accurately the me to populations through blended systems. The rule also includes instructions on how to apportion population for systems with standby wells or standby surface water intakes.

Section 3.3.2.1 Level of contamination. Explains how to evaluate population based on concentrations of hazardous substances in samples. Text was added to assign Level II contamination to any drinking water wells where there is an observed release by direct observation.

Section 3.3.2.2 Level I concentrations. Explains how to evaluate populations exposed to Level I concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 3.3.2.3 Level II concentrations. Explains how to evaluate populations exposed to Level II concentrations. The scoring cap was eliminated, and the multiplier (i.e.,

weight) is now 1.

Section 3.3.2.4 Potential contamination. Explains how to assign values to populations potentially exposed to contamination from the site. The formula for calculating population values has been modified to reflect both the revised method for evaluating karst aquifers (see below) and the use of distance-weighted population values from Table 3-12, which has been added to assign distance-weighted values for populations in each distance category The values are determined for each distance category and are then added across distance categories, and the sum is divided by 10 to derive the factor value for potentially contaminated population. The assigned values in Table 3-12 were determined by -ined by statistical simulation to yield the same , population value, on average, as the use of the formulas in the proposed rule. The use of range values has been adopted as part of the simplification discussed in section III A. The rounding rules have also changed. The method for evaluating karst aquifers has been simplified and is explained in this section. Table 3-14 in the proposed rule, which included dilution weighting factors for the general case and for two special cases, has been removed, and the two special karst cases are no longer evaluated. (The generally applicable dilution factors for karst have not changed and are all incorporated into the distance-weighted population values in Table 3-12.) The scoring cap was eliminated, and the

multiplier (i.e., weight) is now 0.1. Section 3.3.2.5 Calculation of population factor value. Has been revised to reflect the changes in the evaluation of actually contaminated wells. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 3.3.3 Resources. Describes how points are assigned to resource uses of ground water. Points may be

assigned if there are no drinking water wells within the target distance limit, but the water is usable for drinking water. This scoring allows for consideration of potential future uses of the aguifers. (See section III I of this preamble for a discussion of the relative weighting of these factors.)

Section 3.3.4 Wellhead protection area. Explains how to assign values to this factor. The maximum value is assigned when a source or an observed release lies partially or fully within a wellhead protection area applicable to the aquifer being evaluated, and this value has been changed from 50 to 20 to adjust for scale changes. A new criterion for scoring this factor has been added. If a wellhead protection area applicable to the aquifer being evaluated is within the target distance limit and naither of the other conditions is met, a value of five is assigned. This change allows the HRS to place a value on the resource.

Section 3.3.5 Calculation of targets factor category value. Has been revised to reflect changes in the factor names. The rounding rule has been changed, and the scoring cap was eliminated.

Section 3.4 Ground water migration score for an aquifer. Text has been revised to reflect the new divisor for normalizing pathway scores.

Section 3.5 Calculation of ground

water migration pathway score. Text

has been simplified.

In addition to the above noted changes, the sorptive capacity factor has been eliminated and replaced by the depth to aquifer factor, as have the tables used to assign values to this factor (Tables 3-6 and 3-7 in the proposed rule). The ground water use factors have also been eliminated as have the tables used to assign their values (Tables 3-15 and 3-16 in the proposed rule). Figures 3-2, 3-3, and 3and Tables 3-4, 3-8, 3-9, 3-13 of the proposed rule have been removed.

Section 4 Surface Water Migration **Fathway**

The surface water migration pathway evaluates threats resulting from releases or potential releases of hazardous substances to surface water bodies. One major change to this pathway is the addition of a new component for scoring ground water discharge to surface water, either this component or the overland flow/flood migration component or both may be scored. For each component, three threats are evaluated: drinking water threat, human food chain threat, and environmental threat. Other major changes specific to this pathway include elimination of the recreational use threat; simplification of

overland flow potential to release factors; medifications to the human food chain threat including addition of a food chain individual; modifications to the treatment of bioaccumulation potential and addition of a similar factor, ecosystem bioaccumulation potential, to the evaluation of the environmental threat; modifications to the persistence factor; revisions to the dilution weights; additions of benchmarks, extension of benchmarks to evaluation of the nearest intake, and addition of levels of contamination to the human food chain. targets; modifications to criteria for establishing actual food chain contamination; elimination of the surface water use factor; addition of a resources factor to the targets evaluation in the drinking water threat: and revisions to sensitive environments.

Section 4.0 Surface Water Migration Pathway. New structure of the pathway is explained. Descriptive text has been removed. Figure 4-1 has been revised to reflect revisions to the factors evaluated, and Table 4–1 has been revised to reflect the new factor. category values throughout.

Section 4.0.1 Migration components. Explains how to score the two migration components.

Section 4.0.2 Surface water categories. A definition of coastal tidal waters has been added. Some surface water bodies that belong in this new category were listed in other categories in the proposed rule (e.g., bays and wetlands contiguous with oceans). Isolated peremial wetlands have been added to the definition of lakes; salt water harbors largely protected by seawalis have been removed from the definition of lakes. Ocean has been defined more precisely as areas seaward from the baseline of the Territorial Sea. Contiguous bays have been removed from, and wetlands contiguous to the Great Lakes have been added to ocean and ocean-like bedies. These definitional changes/ ciarifications more accurately reflect the different characteristics of the water bodies.

Section 4.1 Overland flow/flocd migration component. As discussed in section III M of this preamble, the surface water migration pathway has been divided into two components. The overland flow/flood component is essentially the surface water migration pathway as proposed except that the recreational use threat has been eliminated.

Section 4.1.1 General considerations. Consists of several subsections.

Section 4.1.1.1 Definition of the hazardous substance migration path for overland flow/flood migration component. Text has been simplified.

Section 4.1.1.2 Target distance limit. Explains target distance limits for sites in general and adds an explanation of low to calculate the target distance limit for contaminated sediments with no identified source. For these latter sources only, when there is a clearly defined direction of flow, the target distance limit is measured beginning at the observed sediment contamination farthest upstoom; when there is no clearly defined direction of flow, the target distance limit is measured from the center of the area of observed sediment contamination. Discusses the determination of whether surface water targets are subject to actual or potential contemination. Also, text was added to actual contemination. Also, text was added to actual contemination based on direct characteries.

Section 4.1.13 Evaluation of the overland flow/flood migration compensat. Explains that for switched watersheds, lighest source assigned to a watershed in used instead of summing watershed scores as proposed.

watershed scores as proposed.

Section 4.1.2 Drinking water threat.

Descriptive text has been removed.

Section 4.1.2.1 Drinking water

threat—likelihood of release. Text has been simplified to clarify when potential to release factors need to be a release.

Section 4.1.2.1.1 Observed release. Text has been syriced to reflect the changed mentions value.

Section 41212 Potential to release. Text has been sevised to reflect the changed maximum value and has been simplified.

Section 4.1.2.1.2.1 Potential to release by overland flow. Explains when overland flow potential to release is not evaluated.

Section 4.1.2.1.2.1.1 Containment.
Text has been revised to reflect changes in the numbering of the containment table. Only sources that meet the anishmum size requirement (i.e., that have a source hezardoes waste quantity value of 0.5 or higher) are used ir assigning containment values. This requirement has been added to ensure that very small, uncontained sources do not unduly influence the score. For example, a site might have a large, but highly contained source and a very small, uncontained source; without a minimum size requirement, the potential to release could be assigned the maximum value based on the very small source, which could overestimate the potential hazard posed by the site. If no source meets the minimum size requirement, the source with the highest

surface water containment factor value is used. Descriptive text has been removed. Table 4–2. Containment Pactor Values for Surface Water Afgration Pathway, has been simplified by combining repetitions items and has been moved from an attachment to the proposed rule into this section of the final rule.

Section 4.1.2.1.2.1.2 Runoff. Text on evaluating rainfall has been simplified by removing explanatory references. The runoff curve number has been plified by substituting a soil group designation in its place. Table 4-4 (proposed rule Table 4-2) has been revised to list only the soil group nations. Based on analyses of renoff and actual drainage area sizes. Table 4-3 (proposed rule Table 4-3) has been revised by changing the divisions of drainage area size. Table 4-5 (proposed rule Table 4-4) has be revised to reflect the changes related to the use of sail group designations. Table 4-6 (proposed rule Table 4-5) has been revised so that the heading in the table reads Rainfall/Runoff Value: the values assigned have been adjusted on the besis of both the higher maximum val assigned to the factor category and the analyses described above. Explanatory text has been removed.

Section 4.1.2.1.2.1.3 Distance to surface water. Values assigned to distance to surface water factor values in Table 4-7 (proposed rule Table 4-6) have been revised to adjust for the higher maximum assigned to the factor category.

Section 4.1.2.1.2.1.4 Calculation of the factor value for potential to release by overland flow. Has not been changed except for assigned value.

Section 4.1.2.1.2.2 Potential to release by flood. Descriptive text has been removed.

Section 4.1.2.1.2.2.1 Containment (flood). Text in Table 4-8 (proposed rule Table 4-7) has been revised to incorporate new language on required documentation on containment. The requirement for certification by an engineer has been dropped. The new documentation requirements have been added to make the rule consistent with RCRA requirements.

Section 4.1.2.1.2.2.2 Flood frequency. Values assigned to this factor by Table 4-8 (proposed rule Table 4-8) have been revised to better reflect probabilities and to adjust for the higher maximum assigned to the factor category. Descriptive text has been removed.

Section 4.1.2.1.2.2.3 Calculation of the factor value for potential to release by flood. Has been revised to reflect a minimum size requirement for sources. Section 4.1.2.1.2.3 Calculation of potential to release factor value. Text has been simplified, and the assigned value has been changed.

Section 4.12.1.3 Calculation of drinking water threat—likelihood of release factor category value. Text has been simplified. The maximum value has been changed, and the maximum for potential to release is no langer equal to the maximum for observed release.

Section 4.1.2.2 Drinking water threat—wests characteristics. Descriptive text has been removed.

Section 4.1.2.2.1 Toxicity/
persistence. Editorial changes have been
made.

Section 4.1.2.2.1.1 Toxicity. References § 2.4.1.1.

Section 4.1.2.2.1.2 Persistence. As discussed in section III F of this reamble, several changes have been ade to this factor, including the deletion of fron-radical excidation as a decay process and the inclusion of consideration of K_{ee} to account for scrytism to sediments. Table 4-10 (proposed rule Table 4-0) has been revised to change the values assigned from categorical numbers to linear scales. The divisions among the halflives for rivers, econos, con stel tidal waters, and Great Lakes have changed based on a study of travel time, and the text has been modified to clarify the procedure for determining whether to bese the persistence factor on lakes or on rivers, econes, constal tidal waters, and Great Lakes. A factor value of 0 is no longer assigned for persistence, as had been the case under the proposed rule, where categorical place-holder values were used; because persistence is now multiplied by textily and hazardous waste quantity, assigning a 0 value would result in a pathway score of 0. This result could understate the risk u. This result could unagrative the risk possed by a site with a large volume of highly textic hazardous substances with low persistence. Purfleemore, given the uncertainties about half-life estimates d their applicability in site-specific mations, EPA determined that a 0 value should not be assigned to the persistence factor under any conditions. The text has been modified to clarify selection of an appropriate default value: Table 4-11—Persistence Values Log K_m, has been added. Descriptive text has been removed.

Section 4.1.2.2.1.3 Calculation of toxicity/persistence factor value. Table reference has been changed to reflect the change in numbering. Table 4-12 (proposed rule Table 4-30) has been changed to reflect the multiplicative relationship.

Section 4.1.2.2.2 Hazardous waste quantity. References § 2.4.2.

Section 4.1.2.2.3 Calculation of drinking water threat—waste characteristics factor category value. Text has been revised to indicate the multiplication of the factors, the new maximum value, and the table used to assign the factor category value.

Section 4.1.2.3 Drinking water threat—targets. Descriptive text has been removed. Text was added to assign Level II to actual contamination based on direct observation.

Section 4.1.2.3.1 Nearest intake. Title and the factor name have been changed. As discussed in Section III B of this preamble, this factor is now assigned values based on health-based benchmarks, instructions for how to assign dilution weights to closed lakes and lakes with no surface flow entering have been added. Table 4-13, Surface Water Dilution Weights (proposed rule Table 4-11], has been revised to add more types of surface water bodies and to change the dilution weights. These changes have been made to reflect more accurately the flow ranges of water bodies and are based on analysis of data on flow rates and dilution.

Section 4.1.2.3.2 Population. As explained above, population is evaluated based on two levels of actual contamination. Targets potentially contaminated are dilution weighted and are assigned values based on ranges. Populations served by intakes which are blended with water from other drinking water sources are to be apportioned based on the intake's relative contribution to the total blended system. The rule includes instructions on the type of data to use when determining relative contributions of intakes and wells. This change is intended to reflect more accurately the exposure of populations through blended systems. The rale also includes instructions on how to apportion population for systems with standby wells or standby surface water intakes.

Section 4.1.2.3.2.7 Level of contamination. Explains how to evaluate population based on the level of contamination to which they are exposed.

Section 4.1.23.2.2 Level 1
concentrations. Descriptive text has
been removed. The scoring cap was
eliminated, and the multiplier (i.e.,
weight) is now 10.

Section 4.1.2.3.2.3 Level II concentrations. Text has been simplified and revised to reflect the changes discussed above. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.2.3.2.4 Potential contamination. Equation used to calculate this factor has been revised as discussed above. A new table, Table 4-14, Dilution-Weighted Population Values for Potential Contamination Factor for Surface Water Migration Pathway, has been added to assign values, which are then added across different surface water body types and divided by 10 to derive the value for potentially centaminated population. The assigned values in Table 4-14 for each population range category were determined by statistical simulation to yield the same population value, on average, as the use of the formulas in the proposed rule. The use of range values has been added as part of the simplification discussed in section III A. The rounding rule has also been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.2.3.2.5 Calculation of population factor value. Explains how to combine values assigned to the three population groups. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 4.1.2.3.3 Resources. As discussed in section III J of this preamble, this factor has been added to account for the potential impact of surface water contamination on resource uses.

Section 4.1.2.3.4 Calculation of drinking water threat—targets factor category value. Has been revised to reflect the changes in this factor category. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 4.1.2.4 Calculation of drinking water threat score for a watershed. Text has been simplified. The divisor has changed.

Section 4.1.3 Human food chain threat. Descriptive text has been removed.

Section 4.1.3.1 Human food chain threat—likelihood of release. Section references have been changed.

Section 4.1.3.2 Human food chain threat—waste characteristics. Text has been simplified.

Section 4.1.3.2.1 Toxicity/
persistence/bioaccumulation. Text has
been simplified and modified because of
the change in the use of
bioaccumulation potential in selecting
the substance potentially posing the
greatest hazard.

Section 4.1.3.2.1.1 Toxicity. Has been changed to reference § 2.4.1.1. Also changed so that evaluation of toxicity is not limited to substances with the highest bioaccumulation potential.

Section 4.1-3.2.1.2 Persistence.
Clarifies how to evaluate persistence for

contaminated sediment sources, and sdds coastal tidal waters as a category of surface water. Also changed so that evaluation of persistence is not limited to substances with the highest bioaccumulation potential.

Section 4.1.3.2.1.3 Bioaccumulation potential. As described in section III M of this preamble, the method of accounting for bioaccumulation potential in the selection of the substance potentially posing the greatest hazard has been changed. In the final rule, bioaccumulation potential is considered together with toxicity and persistence rather than as a primary selection criterion. This change was made because all three factors are now scored on linear scales. In addition. where data exist, separate bioconcentration factor values are assigned for salt water and fresh water. the text now clarifies that the higher of these values is used for fisheries in brackish water and for sites with fisheries present in both salt water and fresh water. The adjustment for biomagnification has been dropped because it tended to double count bioaccumulation. Both Table 4-15 (Table 4-14 in the proposed rule) and the text have been modified to clarify the data hierarchy for assigning bioaccumulation potential factor values. Also, Table 4-15 now makes it clear that the assigned values for bioaccumulation potential are on a linear scale.

Section 4.1.3.2.1.4 Calculation of toxicity/persistence/bioaccumulation factor value. Explains how to calculate a toxicity/persistence/bioaccumulation value. Table 4-16. Toxicity/Persistence/Bioaccumulation, has been added to assign the factor value.

Section 4.1.3.2.2 Hazardous waste quantity. References § 4.1.2.2.2

Section 4.1.3.2.3 Calculation of human food chain threat—wasie characteristics factor category value. Text has been revised to indicate the multiplication of the toxicity/persistence and hazardous waste quantity factor values, subject to a maximum, and the further multiplication of that product by the bioaccumulation potential factor value, subject to a maximum for this second product, and to reference the table for assigning the factor category value.

Section 4.1.3.3 Human food chain threat—targets. Has been revised to reflect addition of the new food chain individual and the deletion of the fishery use factor. As discussed in section III M of this preamble, criteria for establishing a fishery subject to actual contamination have been revised. Text was added to describe the additional

tassue samples that can be used to blish Level I contamination.

Section 41331 Food chain individual. As discussed in section III M of this preamble, this factor is new. This section explains how to sesign a value to the factor.

Section 41332 Population Has sen changed as discussed in section ill

M of this per

Section 413321 Level I concentrations. The approach to calculating this factor value has be revised as discussed in section III M of this prescrible. The sounding rule has pd, the scoring cap was minuted, and the multiplier (i.e., ight) is now 10.

Section 413322 Level [] concentrations. Explains how to assign values as discussed in section III M of this preemble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., hij is now 1.

ction 413323 Potential hum food chain contamination. The approach to calculating this factor value has be revised as discussed in section III M this premible. The rounding rule has custed in section III M of been chinaged, the accoring cap was eliminated, and the multiplier (i.e., eight) is now 0.1.

Section 4.13.3.24 Calculation of the spulation factor value. Text has been revised to coult the maximum. The rounding rule has been changed, and the scoring cap was eliminated.

Section 41333 Calculation of on food chain throat—targets factor pery value. Explains how to te the targets value. The rounding rule has been changed, and the scoring cap was eliminated.

Section 4.1.3.4 Calculation of human food chain threat score for a watershed. Text has been simplified. The divisor

has changed.
Section 4.14 Environmental threat. Descriptive text has been removed. Section 4.1.4.1 Environmental threat—likelihood of release. Section references have been changed.

Section 4.1.4.2 Environmental hreat-weste characteristics. Descriptive text has been removed.

Section 4.1.4.2.1 Ecosystem toxicity/ ersistence/bioeccumulation. Text has on revised to include the addition of ecosystem bioaccumulation potential as Malicative factor.

Section 414211 Ecosystem toxicity. The approach for evaluating ecosystem texicity has been revised.

Additions have been made to the data hierarchy (see section III J of this pressable), and a default value of 100 was added to cover the situation where appropriate aquatic toxicity data were

unavailable for all of the substances being evaluated. T 'vle 4-19 (proposed rule Table 4-23) has been revised to make the factor linear and to eliminate the rating category of 0 (except when data are unavailable for a given substance); these changes make the ecosystem toxicity factor more consistent with the toxicity factor in the other pathways and threats. Text was added to clarify the evaluation of ecosystem toxicity for brackish water.

Section 4.1.4.2.1.2 Persistence. Section references have been changed. Clarifies how to evaluate persistence for contaminated sediment sources, and adds constal tidal waters as a category of surface water.

Section 4.1.4.2.1.3 Ecosystem biooccumulation potential. As explained in section III J of this preamble, this factor is new for this threat and is evaluated similarly to (but with several key differences from) the bioaccumulation potential factor in the an food chain threat.

Section 4.1.4.2.1.4 Calculation of ecosystem toxicity/persistence/ bioaccumulation factor value. Section references have been changed. Table 4-20 (proposed rule Table 4-34) has been changed to reflect the changes in the values for the factors. Table 4-21, Ecosystem Toxicity/Persistence/ Bioaccumulation Values, is new and ms values for the combined toxicity/persistence/bioaccumulation factor.

Section 4.1.4.2.2 Hazardous waste quantity. Section references have been

Section 4.1.4.2.3 Calculation of environmental threat-waste characteristics factor category value. Text has been revised to indicate the multiplication of the ecosystem toxicity/ persistence and hazardous waste quantity factor values, subject to a maximum, and the further multiplication of that product by the ecosystem bioaccumulation potential factor value, subject to a maximum for this second product, and to reference the table for assigning the factor category value.

Section 4.1.43 Environmental threat-targets. Descriptive text has been removed.

Section 4.1.43.1 Sensitive environments. Explains how to evaluate sensitive environments. Table 4-22. **Ecological-Based Benchmarks for** Hazardous Substances in Surface Water, has been revised as described in section III H of this preamble. The rounding rule has also been changed.

Section 4.1.4.3.1.1 Level I concentrations. Explains the new method of evaluating wetlands based on wetland frontage, or, in some situations,

wetland perimeter. Table 4-23, Sensitive Environments Rating Values, has been revised as discussed in section III J of this preemble. Table 4-34, Wetlands Rating Values for Surface Water Migration Pathway, has been added to assign values to wellands based on the total length of wellands. The scoring cap was eliminated, and the multiplier (i.e., ght) is now 10.

Section 4.1.43.12 Level II concentrations. Has been revised to reflect the method of evaluation wetlands. The scoring cap was eliminated, and the multiplier (i.e.,

weight) is now 1.

Section 4.143.13 Potential contomination. Has been revised to reflect the method of evaluating wetlands. The rounding rule has also been changed, the scoring cap was eliminated, and the multiplier (i.e., right) is now 0.1.

Section 4.143.14 Calculation of environmental threat-targets factor category value. Has been revised to remove the maximum from the targets factor category. The rounding rule has also been changed.

Section 4.144 Calculation of environmental threat score for a watershed. Divisor for the threat has changed. A cap of 60 was explicitly placed on the environmental threat score, which results in the same maximum possible threat score as in the proposed rule. (In the proposed rule, mental threat targets were capped at 128, which resulted in an environmental threat score maximum of 60.) However, in the final rule the targets gory is uncapped and can score higher than 120 to compensate for low scores in other factor categories.

Section 4.15 Calculation of overland flow/flood migration component score for a watershed. Explains how to calculate the score for the watershed.

Section 4.16 Calculation of overland flow/flood migration component score. Explains how to calculate the score for moneut besed on the highest ed score (in the proposed rule watershed scores were summed).

Section 4.2 Ground water to surface water migration component. As discussed in section III M of this mble, this component has been added to the role to account for contamination of surface water bodies through ground water migration of hazardous substances. Thus, all sections referring to this component are new.

Section 4.2.1 General considerations.

Section 4.2.1.1 Eligible surface waters. Explains the conditions that must apply before this component is

scored. In general, this component is scored only when there is a surface water within one mile of a source, the top of the uppermost aquifer is at or above the bottom of the surface water, and no aquifer discontinuity is established between the source and the portion of surface water within one mile of the source. Exceptions are also explained.

Section 4.2.1.2 Definition of the hazardous substance migration path for ground water to surface water migration component. Explains that the migration path is defined as shortest straight-line distance, within the aquifer boundary, from a source to surface water.

Section 4.2.1.3 Observed release of a specific hazardous substance to surface water in-water segment. Explains that before an observed release of an individual hazardous substance can be established to the surface water inwater segment, the substance must meet the criteria for an observed release both to ground water and to surface water (this requirement does not affect the actual scoring of observed release). Also clarifies the use of samples from the surface water in-water segment.

Section 4.2.1.4 Target distance limit. Explains the criteria for determining the target distance limit and for establishing whether targets are subject to actual or potential contamination.

Section 4.2.1.5 Evaluation of the ground water to surface water migration component. Explains the general approach for evaluating this component. Figure 4-2, Overview of Ground Water to Surface Water Migration Component, is new. Table 4-25, which is new, provides the scoring sheets for this component.

Section 4.2.2 Drinking water threat. Explains the general approach for evaluating this threat.

Section 4.2.2.1 Drinking water threat—likelihood of release. Explains the general approach for evaluating this factor category.

Section 4.2.2.1.1 Observed release. Explains that scoring an observed release is based on releases to ground water.

Section 4.2.2.1.2 Potential to release. Explains that scoring is based on the scoring of potential release to uppermost aquifer.

Section 4.2.2.1.3 Calculation of drinking water threat—likelihood of release factor category value. Explains how to assign the factor category value.

Section 4.2.2.2 Drinking water threat—waste characteristics. Explains the general approach for evaluating this factor category. Section 4.2.2.1 Toxicity/mobility/ persistence. Explains 'he approach for evaluating these factors.

Section 4.2.2.2.1.1 Toxicity. Explains that toxicity values are assigned to all hazardous substances available to migrate to ground water.

Section 4.2.2.2.1.2 Mobility. Explains that the mobility value is assigned to all hazardous substances available to migrate to ground water.

Section 4.2.2.1.3 Persistence.
Explains that this factor value is assigned as in the drinking water threat for the overland flow/flood migration component for all hazardous substances available to migrate to ground water.

Section 4.2.2.1.4 Calculation of toxicity/mobility/persistence factor value. Explains that the factor value is the highest value assigned to any hazardous substance evaluated using Table 4-28, which is new.

Section 4.2.2.2 Hazardous waste quantity. Explains that hazardous waste quantity is calculated for hazardous substances available to migrate to ground water.

Section 4.22.23 Calculation of drinking water threat—waste characteristics factor category value. Explains how to calculate the factor category value.

Section 4.223 Drinking water threat—targets. Explains the general approach for evaluating this factor category.

Section 4.2.2.3.1 Nearest intake. Explains how to determine the dilution weight adjustment using Table 4-27, which was added, and how to assign factor values. Figure 4-3 was added to illustrate determination of the ground water to surface water angle. (See section III O of this preamble for a discussion of this adjustment.)

Section 4.2.2.3.2 Population. This section parallels other population factor sections.

Section 4.2.2.3.2.1 Level [concentrations. Parallels the population factor sections in the overland flow/ flood migration component.

Section 4.22.3.22 Level II concentrations. Parallels the population factor sections in the overland flow/flood migration component.

Section 4.2.2.3.2.3 Potential contamination. Parallels the population factor sections in the overland flow/flood migration component, except for addition of the dilution weight adjustment.

Section 4.2.2.3.2.4 Calculation of population factor value. Parallels other population factor sections.

Section 4.2.2.3.3 Resources. Parallels other resources factor sections.

Section 4.2.2.3.4 Calculation of the drinking water threat—targets factor category value. Explains how to calculate the factor category value.

Section 4.2.2.4 Calculation of drinking water threat score for a watershed. Explains how to calculate the score for a watershed.

Section 4.2.3 Human food chain threat. Lists the factors evaluated.

Section 4.2.3.1 Human food chain threat—likelihood of release. Explains how to assign the factor category value.

Section 4.2.3.2 Human food chain threat—waste characteristics. Lists the factors evaluated.

Section 4.2.3.2.1 Toxicity/mobility/ persistence/bioaccumulation. Explains how to calculate these factor values using Table 4-28, which is new.

Section 4.23.2.1.1 Toxicity. Explains now to calculate this factor value.

Section 4.23.2.1.2 Mobility. Explains how to calculate this factor value.

Section 4.2.3.2.1.3 Persistence. Explains how to calculate this factor value.

Section 4.2.3.2.1.4 Biooccumulation potential. Explains how to calculate this factor value.

Section 4.2.3.2.1.5 Calculation of toxicity/mobility/persistence/bioaccumulation factor value. Explains how to calculate this value using Tables 3-9, 4-26, and 4-28.

Section 4.23.2.2 Hozardous waste quantity. Explains how to assign the factor value.

Section 4.2.3.23 Calculation of human food chain threat—waste characteristics factor category value. Explains how to calculate this factor category value.

Section 4.2.3.3 Human food chain threat—targets. Explains the factors to be evaluated.

Section 4.2.3.3.1 Food chain individual. Explains how to assign the factor value.

Section 4.2.3.3.2 Population. Explains how to calculate this factor value.

Section 4.2.3.3.2.1 Level I concentrations. Parallels the population factor in the human food chain threat for the overland flow/flood migration component.

Section 4.2.3.3.2.2 Level II concentrations. Parallels the population factor in the human food chain threat for the overland flow/flood migration component.

Section 4.2.3.3.2.3 Potential human food chain contamination. Parallels the population factor in the human food chain threat for the overland flow/flood component, except for addition of the dilution weight adjustment.

Section 423224 Calculation of the population factor value. Explains how to calculate this factor value.

Section 42.3.3 Calculation of /
human food chain threat—targets factor
category value. Explains how to
calculate this factor category value.
Section 42.8.4 Calculation of human

Section 4.2.3.4 Calculation of human food chain threat score for a watershed. Explains how to calculate the score for a varietyhed.

Section 4.24 Environmental threat. Lists the factors evaluated.

Section 4241 | Environmental threat—Moliford of subcare. Explains how to calculate this factor category

Section 4.2.4.2 Revisemental threat—waste characteristics. Explains how to calculate this factor category value.

Section 42421 Resouten toxicity/ mability/persistence/biooccumulation. Replains how to calculate these factor values.

Section 424212 Recognition terricity. Buginins how to calculate this factor value.

Section 424212 Mobility. Explains how to calculate this factor value.
Section 424213 Parsistence.
Explains how to calculate this factor value.

Section 4242.14 Recognition biooccumulation paraetical. Persiliels the accognition biooccumulation evaluation in the evaluation flow/flood component, except expands the species considered as discussed in section III J.

Section 4242.15 Colculation of

Section 4.24.2.15 Colculation of ecosystem toxicity/mobility/persistence/biseccumulation factor value. Explains how to calculate this factor value using Tables 3-0, 4-29, and 4-30, which were added.

Section 4.2.4.2.2 Hexardous waste quantity. Explains how to calculate this factor value.

Section 4.2423 Calculation of environmental threat—waste characteristics factor category value. Explains how to calculate this factor category value.

Section 4243 Environmental threat—targets. Replain, how to calculate this factor category value. Section 42431 Sensitive

Section 4.2.4.3.1 Sensitive arrivonments. Explains how to calculate this factor value.

Section 4243.1.1 Level | concentrations. Parallels factor sections in the overland flow/flood migration component.

Section 4242.12 Level II concentrations. Parallels factor sections in the overland flow/flood migration component.

Section 4.2.4.3.1.3 Potential contamination. Parallels factor sections

in the overland flow/flood migration component, except for addition of the dilution weight adjustment.

Section 4.2.4.3.1.4 Calculation of environmental threat—targets factor category value. Explains how to calculate the value for the factor category.

Section 4.2.4.4 Calculation of environmental threat score for a watershed. Explains how to calculate this threat score for a watershed.

Section 4.2.5 Calculation of ground water to surface water migration component score for a watershed. Explains how to calculate a watershed score for this component.

Section 4.2.8 Calculation of ground water to surface water suggration component score. Explains how to calculate this score based on the scores for watersheds evaluated for this component.

Section 4.3 Calculation of surface water migration pathway score. Explains how to assign the pathway score

In addition to the above noted changes, the recruetional use threat has been eliminated. The drinking water use and other use factors have also been eliminated as have the tables (4–12 and 4–13 in the proposed rule) that related to scoring these factors. Pigures 4–1, 4–2, and 4–3 as well as Tables 4–15, and 4–17 through 4–22 from the proposed rule have been eliminated.

Section 5 Soil Exposure Pathway

The soil exposure pathway evaluates threats resulting from contamination of surface material. The major changes specific to this pathway include revision of the same of the pathway; elimination of children under seven as a population that must be counted and evaluated separately; addition of hazardous waste quantity to the waste characteristics factor category; inclusion of workers in the evaluation of resident population targets; weighting of resident population based on benchmarks; inclusion of the nearest individual factor in both the resident and nearby targets factor category; inclusion of a resources factor in the resident population evaluation; and revisions to the sensitive environments factor.

Section 5.0 Soil Exposure Pathway. The name of the pathway has been changed from onsite exposure to soil exposure. Descriptive text has been removed. Figure 5-1 has been revised to reflect revisions to the factors evaluated. Table 5-1 has been revised to reflect the new factor category values throughout, which were made more consistent with the other pathways.

Section 5.0.1 General considerations. Has been revised to suffect the redefinition of source, discussed in section IE N of this preamble. The methods for establishing areas of observed contamination and for determining the hazardous substances associated with an area of observed contamination have been clarified. The instructions have been revised to make clear that any part of a site that is covered by a parameters or otherwise maintained imperments or otherwise maintained imperments material such as asphalt is not considered in evolunting the pathway.

Section 5.1 Resident population threat. Has been revised to specify when the resident population threat should be evaluated. The requirements state that this threat is scored when there is an axen of observed contamination within the property boundary and within 200 feet of a residence, school, day care center, or workplace, or within the boundaries of terrestrial sensitive environments and specified resources.

Section 5.1.1 Likelihood of exposure. Text has been simplified.

Section 5.1.2 Waste characteristics. Evaluation of waste characteristics has been changed to include hazardous waste quantity as well as toxicity. Hazardous waste quantity was added to the factor category in response to communis that the pulmony did not consider the dose relationship; the combination of hazardous waste quantity and toxicity is a surrogate for that relationship and makes the potavary more consistent with the rest of the rule. The text has been revised to reflect the change.

Section 5.1.2.1 Tomicity. References the section explaining how to assign toxicity factor values.

Section \$1.2.2 Hammious waste stily. This section is new said explains how to assign a value to this factor. Table 5-2. Hazardons Waste Quantity Evaluation Equations for Soil Exposure Pathway, is a revision of Table 2-14 from the proposed rule. This table differs from Table 3-5 of the final rale because generally only the top two feet of an area of observed contamination are considered in evaluating the puthway. Landfills, contaminated soils, waste piles, land treatment areas, dry surface impoundments, and buried/backfilled surface impiundments, which can be evaluated based on their volume in Table 2-5, are evaluated for this pathway using the area measure because the area measure now has a two-foot depth built into the equation. Surface impoundments containing

hazardous substances present as liquids, tanks, and containers may be evaluated based on volume because it is possible that a person could wade, swim, reach, or fall to a depth greater than two feet.

Section 5.1.2.3 Calculation of waste characteristics factor category value. Explains how to combine the toxicity and hazardous waste quantity factor values, subject to the new maximum.

Section 5.1.3 Targets. This factor category has been revised substantially. As discussed in section III N above, the high-risk target population has been eliminated, and workers have been added as targets. Table 5-3, Health-Based Benchmarks for Hazardous Substances in Soils, has been added to list benchmarks appropriate for this pathway.

Section 5.1.3.1 Resident individual.

The resident individual factor has been added for consistency with other pathways.

Section 5.1.3.2 Resident population. Explains how to evaluate the resident population using health-based benchmarks, described in section III H above, and how to estimate this population.

Section 5.1.3.2.1 Level I concentrations. Explains how to assign a value for this new factor.

Section 5.1.3.2.2 Level II concentrations. Explains how to assign a value for this new factor.

Section 5.1.3.2.3 Calculation of resident population factor value. Explains how to calculate this factor

Section 5.1.3.3 Workers. Explains how to evaluate workers.

Section 5.1.3.4 Resources. Explains how to assign values if the area of observed contamination includes land used for commercial agriculture, commercial silviculture, or commercial livestock grazing or production.

Section 5.1.3.5 Terrestrial sensitive environments. The value assigned for this factor has been revised so that the value is based on the sum of the values assigned to terrestrial sensitive environments in areas of observed contamination, rather than on the highest scoring terrestrial sensitive environment. The maximum value that can be assigned to this factor is limited. but is higher than under the proposed rule. The limit is determined by scoring the pathway with only sensitive environments in the targets factor category; the pathway score under these conditions may not exceed 60 points. The sensitive environments listed in Table 5-5 have been modified. The text has been simplified and references changed to correspond to changes in the rule. The rounding rule has been changed.

Section 5.1.3.6 Calculation of resident population targets factor category value. Explains how to calculate the factor category value from the revised factors. The rounding rule has been changed.

Section 5.1.4 Calculation of resident population threat score. Has only minor editorial changes.

Section 5.2 Nearby population threat. Introductory text has been clarified.

Section 5.2.1 Likelihood of exposure. Lists the factors evaluated.

Section 5.2.1.1 Attractiveness/
accessibility. As explained in section III
N of this preamble, the name of this
factor has changed as have the criteria
used to assign values. This factor now
emphasizes the use of the area by the
general public. Descriptive text has been
removed. Table 5-6 (proposed rule
Table 5-4) has been changed by
redefining the criteria and the assigned
values, and by adding a value of 0 for
sites that are physically inaccessible to
the public.

Section 5.2.1.2 Area of contamination. The title of this section has been changed. This factor is now based solely on area of contamination, which relates to the likelihood of exposure, unlike hazardous waste quantity, which serves as part of the surrogate for dose. Values are assigned using Table 5-7, which is new.

Section 5.2.1.3 Likelihood of exposure factor category value. Text has been revised to reflect the new names of the factors. Table 5-8 (proposed rule Table 5-5) has been revised in response to the changes noted above for the attractiveness/accessibility and area of contamination factors.

Section 5.2.2 Waste characteristics. Text has been revised to reflect changes in the factor category.

Section 5.2.2.1 Toxicity. Explains how to evaluate the toxicity factor for the nearby population threat.

Section 5.2.22 Hazardous waste quantity. This section is new, as is consideration of this factor in this threat. As discussed above, this factor has been added in response to comments and to make the pathway more consistent with the other pathways. The section explains how to assign the factor value.

Section 5.2.2.3 Calculation of waste characteristics factor category value. Explains how to combine the toxicity and hazardous waste quantity factor values, subject to the new maximum.

Section 5.2.3 Targets. Descriptive text has been removed.

Section 5.2.3.1 Nearby individual. This section is new and explains how to assign a value to the nearby individual (i.e., resident or student with shortest travel distance) if there is no resident individual. The factor has been added to make the nearby threat consistent with other pathways. Table 5-9, Nearby Individual Factor Values, is new.

Section 5.2.3.2 Population within one mile. This section is new and includes the text that previously appeared under the Targets section. The section explains how to assign a value using Table 5-10. The text has been revised for clarity. Table 5-10, Distance-Weighted Population Values for Nearby Population Threat, is new. The table assigns distance-weighted values forpopulation in each travel distance category. The values in the table were determined by statistical simulation to yield the same population, on average. as the use of the formulas in the proposed rule. The distance weights have been modified as follows: for travel distance of >0 to 1/4 mile, the assigned distance weight is 0.025; for > 1/4 to 1/4 mile, 0.0125, and for > 1/2 to 1 mile, 0.00625. The use of population ranges has been adopted as part of the simplification discussed in section III A.

Section 5.2.3.3 Calculation of nearby population targets factor category value. Text has been revised to reflect the changes in the targets factor category and in the rounding rule.

Section 5.2.4 Calculation of nearby population threat score. Minor editorial changes only.

Section 5.3 Calculation of the soil exposure pathway score. Has been changed to reflect the change in the value used as a divisor.

In addition to the above noted changes, Figures 5-2 and 5-3 and Tables 5-4 and 5-6 from the proposed rule have been removed.

Section 6 Air Migration Pathway

The air migration pathway evaluates the relative threat resulting from releases or potential releases of hazardous substances, either as gases or particulates, to the air. The major changes specific to this pathway include separate evaluation of gas and particulates in the likelihood to release factor category; inclusion of benchmarks to evaluate population and the nearest individual; weighting of sensitive environments based on actual or potential contamination; revision of the distance weights; deletion of the land use factor and inclusion of a resources factor in the evaluation of population: and revisions to the mobility factor.

Section 6.0 Air Migration Pathway.
Descriptive text has been removed.
Figure 6-1 has seen revised to reflect revisions to the factors evaluated, and Table 6-1 has been revised to reflect the new factor category values throughout.

Section 6.1 Likelihood of release.

Section 6.1 Libelihood of release. Her bose revised to eliminate explanatory text and to add instructions about which factors to evaluate for this factor category.

Section 6.1.1 Observed release. As discussed in section III G of this preamble, the specific criteria have been remind.

Section 6.1.2 Potential to release. As explained in section III O of this preemble, the method for evaluating this factor has been revised. Gas potential to release and particulate potential to release are evaluated separately. The explanatory text has been removed:

explanatory text has been removed.
Section 6.1.2.1 Gas potential to release. Explains how this factor is evaluated. Table 6-2 (proposed rule Table 2-8) has been seviced to apply 6.2) to the gas potential to release

Section 6.1.2.1.1 Gas containment.
Descriptive text has been removed.
Table 6-3 (prepared rule Table 2-6) has been simplified. The depth requirements and other containment requirements have been revised based on public comment, the field test, and a review of recent information on covering systems. Consideration of bioges releases has been added. Assigned values have been revised and also reflect the revised maximum value for the factor.

Section 6.2.2.2 Gas source type.

New source types have been added to Table 8-4 (puspessed rule Table 2-6), and the easigned values have been revised. As explained in section III O of this prenable, new source types and subgroups for specific types have been added, in response to comments and the field test, to make this factor easier to evaluate. Treatment of sources when no course meets the minimum size has been clarified.

Section 6.1.2.1.3 Gas migration potential. As explained in section III O of this preemble, this section has been renamed and the appreach for assigning values changed slightly. This section explains how to assign values to each substance and subsequently to the source using Tables 6-6, 6-6, and 6-7. Dry soil relative volatility has been removed as a measure of gas migration potential. The footnotes have been removed from Table 6-5 (proposed rule Table 3-7) and the name has been changed to "Values for Vapor Pressure and Hearry's Constant." The titles of Tables 6-6 and 6-7 have been changed. The values assigned have also been

changed to reflect the revised maximum value for the factor category. Descriptive text has been removed.

Section 6.1.2.1.4 Calculation of gas potential to release value. Explains how to calculate this value.

Section 6.1.2.2 Particulate potential to release. Explains how this factor is evaluated. Table 6-8 (proposed rule Table 2-3) has been revised to apply only to the particulate potential to release factors.

Section 8.1.2.2.1 Particulate containment. References Table 8-0 (Table 2-6 from the proposed rule). The criterie and values assigned using this table have been changed, as discussed in section III O of this presmble. Considerations of depth have been added for particulates.

Section 6.1.2.2. Particulate source type. In response to comments, new kinds of source types and subgroups of source types have been added to make this factor easier to source. The values assigned have been revised to reflect the changed factor category maximum. Treatment of sources when no source meets the minimum size has been challful.

Section 6.1.2.23 Particulate migration potential. Has been remarked Descriptive text has been removed. Proposed rule Pigure 2-3 has been simplified, expanded, and remarked as Pigure 6-2. Proposed rule Table 2-9 has been remarkered as Table 6-10.

Section 6.1.2.2.4 Calculation of particulate potential to release value. Describes how to calculate this value.

Section 8.1.2.3 Calculation of potential to release factor value for the site. Text has been simplified and medified to account for gas and particulate potential to release.

Section 6.1.3 Calculation of likelihood of release factor category value. Describes calculation procedure Section 6.2 Waste characteristics.

Descriptive text has been removed.

Section 6.2.1 Taxicity/mobility. Text has been simplified.

Section 6.2.1.1 Toxicity. Descriptive text has been removed and § 2.4.1.1 is referenced.

Section 6.2.1.2 Mobility. As explained in section III P of this preamble, the scoring of this factor has changed. Gas mobility is now based only on vapor pressure. The maximum value assigned for particulate mobility is no longer the same as the maximum assigned for gas mobility. The particulate mobility values are assigned based on Pigure 6-3 or the equation in the text along with Table 6-12. The values assigned have been put on linear scales to be consistent with the new structure of the waste characteristics

factor category. The text has been simultified.

Section 6.2.1.3 Calculation of toxicity/mebility factor value. Table 6-13, proposed rule Table 2-12, the matrix for assigning texicity/mobility factor values has been revised to reflect the changes in values assigned to both factors.

Section 6.2.2 Hazardous waste quantity. Descriptive text has been removed and § 2.4.2 is referenced.

Section 4.2.9 Calculation of waste characteristics factor category value. The text has been revised to indicate the multiplication of the component factors, the new muximum value, and the table used to eneign the factor category value.

Section 6.2 Targets. The target distance limit has been modified to include targets beyond four miles when an observed release extends beyond that distance. Text has been added to explain how to evaluate populations and sensitive environments exposed to actual contamination. Text was added to clarify that actual contamination based on an observed release established by direct observation should be considered Level M. Table 6-14, Health-Based Benchmarks for Hazandous Substances in Air, has been added to list the benchmarks used for this pathway. Table 6-15, Air Migration Pathway Distance Weights (proposed rule Table 2-16), has been sevised to reflect changes in the distance weights discussed in section III O of this possessible.

Section 6.3.1 Nearest individual. The title has been changed from maximally exposed individual. As discussed above, this factor is now evaluated based on actual contemination and potential contemination. The name of Table 6-16 (proposed rule Table 2-15) has been changed and the values have been revised based on changes to the distance weights. Descriptive text has been removed.

Section 6.3.2 Population. Evaluation of population based on health-based benchmarks has been added as discussed in section III H of this presentle.

Section 6.2.2.1 Level of contamination. Explains how to evaluate population based on concentrations of hazardous substances in samples.

Section 6.3.2.2 Level 1
concentrations. Explains how to
evaluate populations exposed to Level 1
concentrations. The scoring cap was
eliminated, and the multiplier (i.e.,
weight) is now 10.

Section 6.3.23 Level II concentrations. Explains how to

evaluate populations exposed to Level II concentrations.

Section 6.3.2.4 Potential contamination. Explains how to assign values to populations potentially exposed to contamination from the site. The formula for calculating population values has been revised. Table 6-17, which assigns distance-weighted values for populations in each distance category, has been added. The values in the table were determined by statistical simulation to yield the same population, on average, as the use of the formulas in the proposed rule. The use of population ranges has been adopted as part of the simplification discussed in section III A. The rounding rule has been changed, the scoring cap was aliminated, and the multiplier (i.e., weight) is now 0.1.

Section 6.3.2.5 Calculation of the

Section 6.3.2.5 Calculation of the population factor value. Explains how to calculate the factor value. The scoring

cap was eliminated.

Section 6.3.3 Resources. Explains how to assign points to resources, which in this pathway is based on the presence of commercial agriculture, commercial silviculture, and major or designated recreation areas.

Section 6.3.4 Sensitive environments. Explains how sensitive environments are evaluated based on actual and potential contamination. The maximum value that can be assigned to this factor is limited, but is greater than in the proposed rule. The limit is determined by scoring the pathway with only sensitive environments in the targets factor category; the pathway score under these conditions may not exceed 60 points.

Section 6.3.4.1 Actual contamination. Explains how to assign factor values for sensitive environments subject to actual contamination and how to assign values to wetlands based on total acreage. A new Table 6-18, Wetlands Rating Values for the Air Migration Pathway, has been added to assign values to wetlands based on acreage.

Section 6.3.4.2 Potential contamination. Explains how to calculate the factor value for potentially contaminated sensitive environments and how to assign values to wetlands based on total acreage within each distance category. The rounding rule has been changed.

Section 8.3.4.3 Calculation of sensitive environments factor value. Explains how to calculate the factor value. The rounding rule has been

changed.

Section 6.3.5 Calculation of targets factor category value. Text has been revised to reflect the new names for factors.

Section 6.4 Calculation of air migration pathway score. Text has been revised to reflect the new divisor.

In addition to the above noted changes, the land use factor, Figure 2-2, and Tables 2-2, 2-3, 2-13, 2-17, and 2-19 in the proposed rule have been removed.

Section 7 Sites Containing Radioactive Substances

This entire part of the rule is new. As discussed in section III E of the preamble, this section has been added to provide direction on evaluating sites containing radioactive substances.

Table 7-1 lists factors evaluated differently for such sites.

Section 7.1 Likelihood of release/ likelihood of exposure. Explains the approach to evaluating the factor

category.

Section 7.1.1 Observed release/
observed contamination. Explains how
to evaluate observed release (observed
contamination) for radiomiclides. The
evaluation differs for radiomiclides that
occur naturally or are ubiquitous in the
environment, for man-made
radiomiclides without ubiquitous
background concentrations in the
environment, and for gamma-emitting
radiomiclides in the soil exposure
pathway. This section also explains the
appropriate procedures for sites with
mixed radioactive and other hazardous
substances.

Section 7.1.2 Potential to release. Explains that potential to release factors are evaluated on the physical and chemical properties of radionuclides, not their radioactivity.

Section 7.2 Waste characteristics. Lists the factors evaluated.

Section 7.2.1 Human toxicity.

Explains how to assign toxicity values to radioactive substances and describes appropriate procedures for sites containing mixed radiomicides and other hazardous substances.

Section 7.2.2 Boosystem toxicity. Explains that ecosystem toxicity for radionuclides is assigned a value in the same way as is human toxicity except that the default value is 100 rather than 1.000.

Section 7.23 Persistence. Explains that radioactive substances are assigned persistence values based solely on half-life—radioactive half-life and volatilization half-life. Explains how to evaluate persistence for mixed radioactive and other hazardous substances.

Section 7.2.4 Selection of the substance potentially posing greatest hazard. The section explains how to select the substance potentially posing the greatest hazard.

Section 7.25 Hazardous waste quantity. Explains how to evaluate the hazardous waste quantity factor for sites containing radioactive substances.

Section 7.2.5.1 Source hazardous waste quantity for radionuclides.

Describes differences between the migration pathways and the soil exposure pathway.

Section 7.2.5.1.1 Radionuclide constituent quantity (Tier A). Explains how to evaluate radionuclide constituent quantity for radionuclides.

Section 7.2.5.1.2 Radionuclide wastestream quantity (Tier B). Explains how to evaluate radionuclide wastestream quantity for radionuclides.

Section 7.25.1.3 Calculation of source hazardous waste quantity value for radionuclides. Explains how to assign a source value.

Section 7.25.2 Calculation of hazardous waste quantity factor value for radionuclides. Explains how to calculate the hazardous waste quantity factor value for radionuclides and describes use of the minimum value, which is either 10 or 100 (as described in section 2.4.2.2 above).

Section 7.2.5.3 Calculation of hazardous waste quantity factor value for sites containing mixed radioactive and other hazardous substances. Explains how to calculate the factor value for these sites.

Section 7.3 Targets. Explains how to evaluate targets at sites containing radioactive substances and sites containing radioactive and other hazardous substances.

Section 7.3.1 Level of contamination at a sampling location. Explains how to determine the appropriate level of contamination.

Section 7.3.2 Selection of benchmarks and comparisons with observed release/observed contamination. This section lists the benchmarks and explains how they are used in determining the level of contamination.

V. Required Analyses

A. Executive Order No. 12291

Under Executive Order No. 12291, the Agency must judge whether a regulation is "major" and thus subject to the requirement of a Regulatory Impact Analysis. The rule published today is not major because the rule will not result in an effect on the economy of \$100 million or more, will not result in increased costs or prices, will not have significant adverse effects on competition, employment, investment, productivity, and innovation, and will

not significantly discupt domestic and expert markets.

To estimate the costs associated with the final rule, a final economic analysis catified "Economic Impact Analysis of the Revised Hussed Ranking System" was prepared as an addendum to the Decomber 1967 economic impact analysis (EIA) to incorporate new data. As in the January 1906 EIA, the total susual cost of implementing the final rule is estimated as a function of the number of Screening Sie (SSI) and Listing Sie (LSI) that will be conducte y and the unit cost of each. In the ry 1998 EIA, estimates of total costs were developed assuming 1,230 SSIs and 100 LSIs would be conducted sally. The Agency now estimates 1,360 Sis will be conducted sally (EPA is no longer using the **t**et 1.3 terms 957 and LSI). The total accor cost is estimated to be \$78.8 million, the m of the cost of conducting 1,080 Six at a unit cost of \$55,000, 70 Siz for NFT. sites (without manifering wells) at a unit cost of \$200,000, and 30 Sie for NPT, sites (with mountaing wells) at a unit cost of

To estimate the incremental cost of implementing the final seviced version of the HRS, the unit cost of conducting all pourosocial listing activities using the current HRS from the Jennery 1906 EIA, and was developed accuming the PA had already been conducted. The 1906 estimate is a function of 400 hours of Field Investigation Team (FIT) technical time valued at 300 per hour and 30 samples being evaluated at a unit cost of \$1,100 per sample. To compare the costs of the current HRS to those developed above for the final revised version of the HRS, the FIT technical time is valued at \$500 per hour and each sample evaluation is estimated to cost \$1,000. The revised total cost of conducting all listing activities beyond the PA for the current HRS, therefore, is estimated to be \$50,000, in addition, the average level of effort for a PA under the current HRS is estimated to be \$50,000, in addition, the average level of effort for a PA under the current HRS is estimated to be \$50,000.

Based on these revisions, the annual cost of using the current HRS is estimated to be \$65.4 million, the sum of the cost of conducting 2,800 PAs at a unit cost of \$3,800 (98 million) and the cost of conducting 1,300 Sis at a unit cost of conducting 1,300 Sis at a unit cost of \$54,800 (980.4 million). Compared to the current HRS, the annual incremental cost of using the final revised version of the HRS is estimated to be \$13.4 million. On the basis of this evaluation, implementing the final

revised version of the HRS would not constitute a major rule, because the autural incremental cost of the final rule is less than \$100 million. No negative economic effects are anticipated from this rule.

B. Regulatory Flexibility Determination

Appendix A of the December 1987 EIA cludes an assessment of the ability of ponsible parties to pay the costs of HRS scoring under the current HRS and the three alternative scoring schanisms considered at that the That emplyis evaluated the impact of HIRS costs under each renking methodology on the financial viability of 15 sample companies. Under that earlysis, only the smallest sample firm (one with an everage not income of \$53.700) was expected to have difficulty in paying the costs of conducting a e SI under each of the alternative ranking scenarios. The new unit cost of a complete SI developed during the Phase ! field test and used in this ecinemic analysis falls within the range of costs already evaluated in eadix A of the December 1967 EIA. Civen the previous enalysis, EPA concludes that most sample firms are bealthy enough financially to be able to afford the expanditures associated with HPS site inspections. Responsible Parties (RPs) that are finencially similar to the smallest firm (Firm 15 in appendix A of the December 1987 RIA), however, do not have the assets or the income to enable them to assume payments similar to the estimates derived for the SI done under the current HRS or the final recised version of the HRS.

The Regulatory Flexibility Act of 1980 requires that Federal agencies explicitly consider the effects of proposed and existing regulations on small entities and examine alternative regulations that would reduce significant adverse impacts on small entities. The small estities that could be affected by the revisions to the HRS are small businesses and small ampicipalities that are responsible for hazardous wastes at a site. Based on the updated analysis presented here, EPA concludes that using the final rule is unlikely to result in a **significant impo**ct on a substantial aber of small entities. As discussed in the December 1987 ELA, this conclusion is drawn because small firms are no more or less likely to be responsible parties than are large firms. in addition, when they are RPs. small firms usually are one of several companies responsible for a site and probably would not bear the full burden of Bability for HRS expenditures and other cleanup costs.

C. Paperwork Reduction Act

The information collection requirements contained in this rule have been approved by the Office of Management and Budget (OMS) under the provisions of the Paperwork Reduction Act; 44 U.S.C. 3501 et sequand has assigned OMS control number 2059-0005.

Public seporting burden for this collection of information is estimated to be \$20 hours per sesponse, including time for seviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, information Policy Branch, PM—U.S. Environmental Protection Agency, 401 M St., SW., Washington, DC 20160; and the Office of Information and Regulatory Affairs, Office of Management and Endget, Washington, DC 20503, marked "Attention: Desk Officer for EPA."

D. Federclism Implications

E.O. 12612 requires agencies to assess whether a regulation will have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPA has determined that this regulation does not have federalism implications and that therefore, a Federalism Assessment is not required.

List of Subjects in 40 CFR Part 100

Air pollution controls, Chemicals, Fiazardous materials, Intergovernmental relations, Natural resources, Oil pollution, Reporting and recordisceping, Superfund, Waste treatment and disposel, Water pollution control, Water supply.

Dated: November 9, 1988. William K. Beilly. Administrator.

40 CFR part 300 is amended as follows:

PART 300-{AMENDED}

1. The authority citation for part 300 continues to read as follows:

Authority: 42 U.S.C. 9885; 33 U.S.C. 1321(c)(2); E.O. No. 117535; 38 FR 21243; E.O. No. 12580; 52 FR 2821.

2. Part 300, appendix A is revised to read as follows:

Appendix A to Part 300—The Hazard Ranking System

Table of Contents

List of Figures List of Tables

1.6. Introduction.

1.1 Definitions.

2.0 Evaluations Common to Multiple Pathways.

21 Overview.

2.1.1 Calculation of HRS site score.

2.1.2 Calculation of pathway score.

2.1.3 . Common evaluations.

2.2 Characterine sources.
2.2.1 Identify sources.

2.2.2 Identify hazardous substances associated with a source.

2.2.3 Identify hexards us substances available to a pathway.

2.3 Likelihood of release.

2.4 Waste characteristics.

2.4.1 Selection of substance potentially posing greatest hexard.

24.1.1 Toxicity factor.

2.4.1.2 Hazardous substance selection.

2.4.2 Hazardous waste quantity.

2.4.2.1 Source hazardous waste quantity. 2.4.2.1.1 Hazardous constituent quantity.

2.4.2.1.2 Hazardous wastestream quantity.

24.213. Volume.

2.4.2.1.4 Area.
2.4.2.1.5 Calculation of source hazardous

waste quantity value.
2.4.2.2 Calculation of hazardous waste

quantity factor value.

2.4.3 Waste characteristics factor category value.

2.4.3.1 Factor category value.
2.4.3.2 Factor category value, considering bioaccumulation potential.

2.5 Targets:

2.5.1 Determination of level of actual contamination at a sampling location.
2.5.2 Comparison to benchmarks.

3.0 Ground Water Migration Pathway. 3.0.1 General considerations.

3.0.1.1 Ground water target distance limit.
3.0.1.2 Aquifer boundaries.

3.0.1.2.1 Aquifer interconnections. 3.0.1.2.2 Aquifer discontinuities.

3.0.1.3 Keest aquifer.

3.1 Likelihood of release.

3.1.1 Observed release

3.1.2 Potential to release.

3.1.2.1 Containment.
3.1.2.2 Net precipitation.

3.1.2.3 Depth to aquifer.

3.1.2.4 Travel tim

3.1.2.5 Calculation of potential to release

3.1.3 Calculation of likelihood of release factor category value.

3.2 Waste characteristics.

3.2.1 Toxicity/mobility.

3.2.1.1 Toxicity. 3.2.1.2 Mobility.

3.2.1.3 Calculation of toxicity/mobility factor value.

3.2.2 Hazardous waste quantity.

3.2.3 Calculation of waste characteristics factor category value.

3.3 Targets.

3.3.1 Nearest well.

3.3.2 Population.

3.3.2.1 Leve' of contamination.

3.3.2.2 Level I concentrations.
3.3.2.3 Level II concentrations.
3.3.2.4 Potential contemination.

3.3.2.5 Calculation of population factor

val

3.3.3 Resources.
3.3.4 Wellhood Protection Area.

3.3.5 Calculation of targets factor category

3.4 Ground water migration score for an

3.5 Calculation of ground water migration pethway score.

4.0 Surface Water Migration Pathway.

4.0.1 Migration compensate.
4.0.2 Surface water estagories.
4.1 Overland/flood migration of
4.1.1 General considerations. tion component.

4.1.1.1 Definition of hexardo

migration path for overland/flood mation com 4.1.1.2 Target distance limit.
4.1.1.3 Evaluation of overland/flood

migration compo

4.1.2 Drinking water threat.
4.1.2.1 Drinking water threat-likelihood of

4.1.2.1.1 Observed release.

4.1.2.1.2 Potential to release. 4.1.2.1.2.1 Potential to release by overland

4.1.2.1.2.1.1 Containment.

4121212 Rmoff.

4.1.2.1.2.1.3 Distance to surface water.

41.21.2.1.4 Calculation of factor value for potential to release by overland flow.

4.1.2.1.2.2 Potential to release by flood. 4121221 Containment (flood).

4121222 Flood frequency.

4.1.2.1.2.2.3 Calculation of factor value for

potential to release by flood. 4.1.2.1.2.3 Calculation of potential to

release factor value. 4.1.2.1.3 Calculation of drinking water threat-likelihood of release factor category value.

4.1.2.2 Drinking water threat-waste characteristics.

41.2.2.1 Toxicity/persistence.

412211 Toxicity. 412212 Persistence.

4.1.2.2.1.3 Calculation of toxicity/ persistence factor value.

41.2.2.2 Hazardous waste quantity. 4.1.2.2.3 Calculation of drinking water threat-waste characteristics factor category value.

4.1.2.3 Drinking water threat-targets.

4.1.2.3.1 Nearest intake. 4.1.2.3.2 Population.

4.1.2.3.2.1 Level of contamination. 4.1.2.3.2.2 Level I concentrations.

4.1.2.3.2.3 Level II concentrations.

412324 Potential contamination.

4.1.2.3.2.5 Calculation of population factor value.

4.1.2.3.3 Resources.

4.1.2.3.4 Calculation of drinking water threat-targets factor category value.
4.1.24 Calculation of the drinking water

threat score for a watershed.

4.1.3 Human food chain threat.

4.1.3.1 Human food chain threatlikelihood of release.

4.1.3.2 Human food chain threat-waste characteristics.

4.1.3.2.1 Toxicity/persistence/

bioeccumulation

4.1.3.2.1.1 Toxicity. 4.1.3.2.1.2 Persistence.

4.1.3.2.1.3 Bioaccumulation potential.

4.1.3.2.1.4 Calculation of toxicity/ persistence/bioaccumulation factor value.

4.1.3.2.2 Hazardous waste quantity. 4.1.3.2.3 Calculation of human food chain

threat-waste characteristics factor category value.
4.1.3.3 Human food chain threat-targets.
4.1.3.3.1 Food chain individual.

4.1.3.3.2 Population. 4.1.3.3.2.1 Level I concentrations.

4.1.3.3.2.2 Level II concentrations

4.1.3.3.2.3 Potential human food chain

4.1.3.3.2.4 Calculation of population factor value...

4.1.3.3.3 Calculation of human food chain

threat-targets factor category value.

4.1.3.4 Calculation of human food chain threat score for a watershed.

4.1.4 Environmental threat.

4.1.4.1 Environmental threat-likelihood of release

4.1.4.2 Environmental threat-waste characteristics.

4.1.4.2.1 Ecosystem toxicity/persistence/ bioaccumulation.

4.1.4.2.1.1 Ecosystem toxicity. 4.1.4.2.1.2 Persistence.

4.1.4.2.1.3 Ecosystem bioaccumulation potential.

4.1.4.2.1.4 Calculation of ecosystem . toxicity/persistence/bioaccumulation factor value.

4.1.4.2.2 Hezardous waste quantity.

4.1.4.2.3 Calculation of environmental threat-waste characteristics factor

category value. 4.1.4.3 Environmental threat-targets.

4.1.4.3.1 Sensitive environments.

4.1.4.3.1.1 Level I concentrations. 4.1.4.3.1.2 Level II concentrations.

4.1.4.3.1.3 Potential contamination. 4.1.4.3.1.4 Calculation of environmental

threat-targets factor category value. 4.1.4.4 Calculation of environmental

threat score for a watershed. Calculation of overland/flood migration component score for a watershed.

4.1.6 Calculation of overland/flood

rigration component score. 4.2 Ground water to surface water migration

4.2.1 General Considerations.

4.2.1.1 Eligible surface waters. 4.2.1.2 Definition of hazardous substance migration path for ground water to

surface water migration component. 4.2.1.3 Observed release of a specific hazardous substance to surface water in-

water segment.

4.2.1.4 Target distance limit. 4.2.1.5 Evaluation of ground water to

surface water migration component.

4.2.2 Drinking water threat. 4.2.2.1 Drinking water threat-likelihoo of

release.

4.2.2.1.1 Observed release. 4.2.2.1.2 Potential to release.

4.2.2.3 Calculation of drinking water funct-likelihood of release factor category volus.

4.2.2 Drinking water threat-waste characteristics.

42221 Tunkity/mobility/persistence. 422211 Tunkity.

422212 Heldy.

422213 Pagis

422214 Calculation of texicity!

mehity/possistence factor value.
42223. Hazaritus waste questity.
42223. Calculation of detaking water
threat-waste characteristics factor

4223 Drinking water throat targets. 42231 Necestintole.

42232 Rembiles

422321 Level I concentrations

422322 Level II concentrations.

422323 Potential contamination.

422324 - Calculation of population factor

42233 B

42234 Records. 42234 Calculates of drinking water:

threat tregets factor category volu 42.24 Calculation of delating water threat score for a wetershed.

423 F بنه لبط هد 4231 Florer fred chelp florer

Mand of salesce. 4232 Ihmen food chiln threat-weste

characteristics.

42321 Twicky/mobility/persistence/ bioaccumulation.

423211 Tonichy.

423212 Mehity.

121213 Peristance.

423214 Moscoundation potential. 423215 Calculation of toxicity/

mobility/parsistance/bisecca factor W

factor votes.
42322 Herandous weate quantity.
42323 Calculation of Junea fact chain threat-weate characteristics factor

cotagory value.

4233 Human final choin throat surpris. 42333 Real chain individual.

42112 Population.

423321 Level Lorscontrollers.

423322 Level II concustrations. 423323 Potential human food chein

423324 Calculation of population factor

42333 Calculation of human food chain

threat-trepts factor collegary value.
42.3.4 Calculation of human food chain threat score for a watershad.
2.4 Businessmooth threat. 424 Environmental St

4241 Environmental threat-likelihood of

4242 Environmental threat-wayte chemoteristics.

42.421 Ecosystem testicity/mobility; paraistance/biseccomulation.

42421.1 Ecosystem tenticity.

424212 lebity.

424213 Peristance.

424214 Ecosystem bisoccumulation potential

424215 Calculation of ecosystem tenicity/mobility/persistence/ brooccusulation factor value.

42422 Hazardous waste quantity.

4.2.4.2.3 Calculation of environmental threat-waste characteristics factor category value

4.2.4.3 Environmental threat-targets. 4.2.4.3.1 Sensitive environments.

424311 Level I concentrations. 424312 Level II concentrations. 424313 Potential contentination.

4.2.4.3.1.4 Calculation of environment

threat-targets factor category value.
4.2.44 Calculation of environmental

threat score for a watershed.

4.2.5 Calculation of ground water to surface water migration component score for a watershed.

4.2.6 Calculation of ground water in surface water migration component score. 4.5 Calculation of surface water migration

pathway score.
5.0 Soll Exposure Pathway.
5.0.1 General considerations.

5.1 Resident population threat. 5.1.1 Likelihood of exposure. 5.1.2 Waste characteristics.

\$121 Toxicity.

5.1.2.2 Hazardons waste quantity. 5.1.2.3 Calculation of waste

characteristics factor category value.

5.1.3 Targeta.

5.1.3.1 Resident individual.

5.1.3.2 Resident population.

\$1321 Level | concentrations.

5.1.3.2.2 Level II concentrations. 5.1.3.2.3 Calculation of resident

population factor value. 5.1.3.3 Workers.

5.1.3.4 Resources.
5.1.3.5 Terrestriel sensitive environments.
5.1.3.6 Calculation of resident population

targets factor category value.
5.1.4 Calculation of resident population timest score.

5.2 Nearby population figure. 5.2.1 Likelihood of exposure.

\$21.1 Attractiveness/accessibility.

5.2.1.2 Area of contamination.

5.2.1.3 Likelihood of exposure factor category value. 5.2.2 Waste characteristics.

5.2.2.1 Toxicity.

5.2.2.2 Hazardous waste quantity.

\$223 Calculation of wester characteristics factor category value.

5.2.3 Targets.
5.2.3.1 Hearby individual.
5.2.3.2 Population within 1

ion within 1 mile.

5.2.3.3 Calculation of nearby population

targets factor category value.
5.2.4 Calculation of searby population threat score.

5.3 Calculation of soil exposure pathway SCOTE.

6.0 Air Migration Pethway. 6.1 Likelihood of release.

6.1.1 Observed release.

6.1.2 Potential to release.

6.1.2.1 Gas potential to release.

6.1.2.1.1 Ges containment.

61.2.1.2 Gas source type.

6.3.2.1.3 Gas migration potential. 6.1.2.1.4 Calculation of gas potential to release value.

6.1.2.2 Particulate potential to release.

6.1.2.2.1 Particulate containment.

6.1.2.2.2 Particulate source type.

6.1.2.2.3 Particulate migration potential.

6.1.2.2.4 Calculation of particulate potential to release value.

6.1.2.3 Calculation of potential to release

factor velue for the site.
6.1.3 Calculation of likelihood of release

factor category vale 6.2 Waste characterist

6.2.1 Teority/mobility.

6211 Tenicipi

6213 Mobility. 6213 Colculation of texticity/mobility factor value.

8.2.2 Heatefore weste questily. 8.2.3 Celculation of weste characteristics factor category value.

63 Tagets.
**Secret individual.

632 Populatio

6323 Level of contomination. 6322 Level I concentrations.

4.3.2.3 Level E concentrations. 8.3.2.4 Potential contemporation.

63.25 Calculation of population factor

633 Resources.

6.3.4 Semilire cert

6341 Admilanta

63.62 Potential contemination

63.43 Calculation of separitive cuts factor v

6.3.5 Calculation of targets factor category

6.4 Calculation of air migration pathway

7.9 Shee Containing Redirective Schelances.

7.1 Likelihood of release/likelihood of

7.1.1 Charved selecte/observed Contract

7.1.2 Patential to sulpase.

7.2 Waste characteristics.

7.2.1 Human tendeity.

yaten tericily. 7.2.2 Eq.

723 Paristance. 7.2.4 Selection of substance potentially

pooling grantest hazard.
7.2.5 Hazardous weeks quantity.

7.25.1 Source h stacious wests quantity for polismachiles.

7.2.5.1.1 Radiosuclide constituent quantity (Tiet A)

7.2.5.1.2 Radiometide wastestrain

quantity (Tier II).
7.2.5.1.3 Calculation of source legardocs waste quantity value for radiosucides.
7.2.5.2 Celculation of languages waste

quantity factor value for radiomedides.
7.253 Calculation of legandous waste quentity factor value for sites containing ized radioactive and other hazardous

substances.

7.3 Targets. 7.3.1 Level of contamination at a sampling location.

7.3.2 Comparison to benchmarks.

List of Figures

Figure number

3-1 Overview of ground water migration pethway.

3-2 Net precipitation factor values.

4-1 Overview of surface water overland! flood seignation component.

- 4-2 Overview of ground water to surface water migration component.
- Sample determination of ground water to surface water angle.
- Overview of soil exposure pathway. Overview of air migration pathway.
- 6-2 Particulate migration potential factor
- 6-3 Particulate mobility factor values.

List of Tables

Table number

- Sample pathway socresheet.
- Sample source characterization warksheet
- Observed release criteria for chemical analysis.
- Toxicity factor evaluation.
- Hazardous waste quantity evaluation equations.
- 2-6 Hazardous waste quantity factor
- Waste characteristics factor category
- Ground water migration pathway
- Containment factor values for ground water migration pathway.
- Monthly latitude adjusting values
- Net precipitation factor values.
- Depth to aquifer factor values
- 3-6 Hydraulic conductivity of geologic materials.
- Travel time factor values.
- Ground water mobility factor values
- 3-9 Toxicity/mobility factor values. 3-10 Health-based benchmarks for
- hazardous substances in drinking water. 3-11 Nearest well factor values.
- 3-12 Distance-weighted population values for potential contamination factor for ground water migration pathway. Surface water overland/flood migration
- component scoresheet.
- Containment factor values for surface water migration pathway.
- Drainage area vaines.
- Soil group designations. Rainfall/runoff values.
- Runoff factor values. 4-6
- Distance to surface water factor values.
- Containment (flood) factor values.
- Flood frequency factor values. Persistence factor values—half-life.
- 4-11 Persistence factor values-log K.
- 4-12 Toxicity/persistence factor values.
- 4-13 Surface water dilution weights.
- 4-14 Dilution-weighted population values. for potential contamination factor for surface water migration pathway.
- 4-15 Bioaccumulation potential factor values
- 4-16 Toxicity/persistence/bioaccumulation factor values
- 4-17 Health-based benchmarks for hazardous substances in human food chain.
- 4-18 Human food chain population values.
- Ecosystem toxicity factor values. 4-19
- 4-20 Ecosystem toxicity/persistence factor values.
- 4-21 Ecosystem toxicity/persistence/ bioaccumulation factor values.
- 4-22 Ecological-based benchmarks for bazardous substances in surface water.
- Sensitive environments rating values.

- 4-24 Wetlands rating values for surface water migration p .thway.
- 4-25 Ground water to surface water migration component scoresheet
- 4-26 Toxicity/mobility/persistence factor values
- 4-27 Dilution weight adjustments.
 4-28 Toxicity/mobility/persistence/ bioaccumulation factor value
- 4-29 Ecosystem toxicity/mobility/ persistence factor values.
- 4-30 Ecosystem toxicity/mobility/ persistence/bioaccumulation factor values
- 5-1 Soil exposure pathway scoreshest.
 5-2 Hazardous waste quantity evaluation quations for soil exposure pathway.
- Health-based benchmarks for hazardous substances in soils.
- **Factor values for workers.**
- Terrestrial sensitive environments rating values.
- Attractiveness/accessibility values. Area of contamination factor values.
- Nearby population likelihood of
- exposure factor values Nearby individual factor values.
- 5-10 Distance-weighted population values for nearby population threat. 6-1 Air migration pathway scoresheet.
- Gas potential to release evaluation.
- Gas containment factor values.
- Source type factor values.
- Values for vapor pressure and Henry's
- Ges migration potential values for a hazardous substance.
- Gas migration potential values for the
- Particulate potential to release evaluation.
- 6.0 Particulate containment factor values.
- 6-10 Particulate migration potential values.
- Gas mobility factor values.

 Particulate mobility factor values. 6-11 6-12
- 6-13 Toxicity/mobility factor values. 6-14 Health-based benchmarks for hazardous substances in air.
- 6-15 Air migration pathway distance weights.
- 6-16 Nearest individual factor values.
- Distance-weighted population values for potential contamination factor for air
- 6-18 Wetlands rating values for air migration pathway.
- HRS factors evaluated differently for radionuclides.
- 7-2 Toxicity factor values for radionuclides.

1.0 Introduction

The Hazard Ranking System (HRS) is the principal mechanism the U.S. Environmental Protection Agency (EPA) uses to place sites on the National Priorities List (NPL). The HRS serves as a screening device to evaluate the potential for releases of uncontrolled hazardous substances to cause human health or environmental damage. The HRS provides a measure of relative rather than absolute risk. It is designed so that it can be consistently applied to a wide variety of

1.1 Definitions

Acute toxicity: Measure of toxicological responses that result from a single exposure to a substance or from multiple exposures within a short period of time (typically several days or less). Specific measures of acute toxicity used within the HRS include lethal dose₂₀ (LD₂₀) and lethal concentration₅₀ (LCas), typically measured within a 24-hour to 96-hour period.

Ambient Aquatic Life Advisory Concentrations (AALACs): EPA's advisory concentration limit for acute or chronic toxicity to aquatic organisms as established under section 304(a)(1) of the Clean Water Act, as amended.

Ambient Water Quality Criteria (AWQC): EPA's maximum acute or chronic toxicity concentrations for protection of aquatic life and its uses as established under section 304(a)(1) of the Clean Water Act, as

Bioconcentration factor (BCF): Measure of the tendency for a substance to accumulate in the tissue of an aquatic organism. BCF is determined by the extent of partitioning of a substance, at equilibrium, between the tissue of an aquatic organism and water. As the ratio of concentration of a substance in the organism divided by the concentration in water, higher BCF values reflect a tendency for substances to accumulate in the tissue of aquatic organisms. [unitless].

Biodegradation: Chemical reaction of a substance induced by enzymatic activity of

microorganisms.

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (Pub. L. 96-510, as amended).

Chronic toxicity: Measure of toxicological responses that result from repeated exposure to a substance over an extended period of time (typically 3 months or longer). Such responses may persist beyond the exposure or may not appear until much later in time than the exposure. HRS measures of chronic toxicity include Reference Dose (RfD) values

Contract Laboratory Program (CLP): Analytical program developed for CERCLA waste site samples to fill the need for legally defensible analytical results supported by a high level of quality assurance and documentation.

Contract-Required Detection Limit (CRDL). Term equivalent to contract-required quantitation limit, but used primarily for inorganic substances

Contract-Required Quantitation Limit (CRQL): Substance-specific level that a CLP laboratory must be able to routinely and reliably detect in specific sample matrices. It is not the lowest detectable level achievable. but rather the level that a CLP laboratory should reasonably quantify. The CRQL may or may not be equal to the quantitation limit of a given substance in a given sample. For HRS purposes, the term CRQL refers to both the contract-required quantitation limit and the contract-required detection limit.

Curie (Ci): Measure used to quantify the amount of radioactivity. One corre equals 37 billion nuclear transformations per second. and one picocurie (pCi) equals 10-12 Ci.

Decay product: isotope formed by the radioactive decay of some other isotope. This newly formed isotope possesses physical and chemical properties that are different from

ne of its parent insteps, and may also be

ctive. ction Limb (III.): Lowest passent (distinguished from the passed rea of an analytical instrument or ed. Per IES purposes, the detection used in the method detection limit Next word is the method detection limit PADL) or, for seal-time field instruments, the limit of the lasts

the Sold.

Diffetion weight Parameter in the ISS surface water nigorium pathway that subsect the path white entigorium in the ISS of the Story or depth of the subsect instace water body increases, furtilized.

Distorter weight Parameter in the ISS of nigorium, ground water nigorium, and solf represent pathways that reduces the paint value contigned to targets up their distract increases from the site. [million].

Thirdfireting conflicted (Tab Manager of

men the site (mather) the conflicted (Ke) 14 if partitioning et of partitioning of a substance a geologic materials (for excepts, self, A, socia) and water (also called n gesteple meterials (for econs at, meh) and water (also callo n coefficient). The distribution ant to youd in the HTS in evol publics cod to makilly of a sak water expedien --

indiciont is used in the importance for the ground in mahility of a substance for the ground lister edgesters pathway, [ml/g].

ED_m (20 parent effective desay): Estimate the associated with a 10 parent increase tapants over casted groups. For HES amounts over casted groups.

paste their custons propositioned in customers, the proposes constitued in customers the paste to the paste t Princip Prod, programme of a pro-struction constitution of a pro-defectations substitutes in human fixed or extend fixed at or observe which FDA well take from to promote adultmental products enhant find at ar above which PLIA was we ingel orders to remove adultmental products from the method. Only PDAALs are thicked for fish and shellful cipply in the HES.

Hilly life Lough of time required for an initial assessment of a substance to be

tial estimatestion of a substance to be lead on a sands of less through decay. The IS considers two decay processes: ridegeodestess, hydrolysis, photolysis, florestess decay, and volutilanties. Hancedone culottance: CERCLA becombout totances, pollutants, and conteminants as flored in CERCLA sections 180(14) and when the conteminants as flored in CERCLA sections 180(14) and

#(10), except where otherwise specifically ted in the HES.

Securities restricted to Material
Adulacy CERCLA houndows enbetween
defined in CERCLA section 181(14) that
a deposited, stared, disposed, or placed in. was deposited, eterod, disposed across or destroited to places or destroited to, a source. ISSS "Justice"? Primary rading elements internal to the ISSS.

HBS "Inches entagery": Set of HBS Sectors (that in Mullimed of minuse for exposure), waste characteristics, tergors). HBS "infrastion pathropy": HBS ground waste, authors water, and air infrastion

pethrage.

1905 'pethrage': Set of 1905 factor

categories combined to produce a source to
measure relative risks posed by a sixt in one
of four our leasurement pethrages (that is,
ground water, surface water, sell, and air). HRS "site score": Composite of the four

HRS podrany school ry's low constant Measure of the to actific selection of a substance in a dilute solution of

veter at equilibrium. It is the satio of the veper pressure exerted by a substance in pe over a dilete aqueeus solutes in the pe over a dilete aqueeus solutes of stance to its concentration in the at a given terrassonalist. gas phose sour a district of that substance to its conce that substance to its compositation in the solution at a given temperature. For IRIS purposes, use the value reported at or sear 25°C. Judinosphare-cubic maters per male (atm-or-finally.

Hydrolysic Chamical searcien of a substance with water.

Karat Turnels with characteristics of salid

and desirance crising from a high degree of rock exhibitity in natural waters. The majority of least occus in limestones, but least may also form in deleastic, gypens, and salt depeats. Posture associated with least least may also term as associated with tenseals depeats. Peatures associated with tenseals depeated typically include (coupler topography, stakholes, vertical shalls, about tidges, caverns, observant springs, mal/or disappearing streams. Knext squilers are associated with least tensein.

LC₁₀ (lettled concentration, 39 percent): Concentration of a substance in air faysical micrograms per cubic meter (µq/m²) or waster (pylically micrograms per liter [qq/m²] does tells 30 percent of a group of expected to a group of expected

water pypically man of a p that hills 10 percent of a p manisms. The LC_m is un taxicity. y micrograms per liter [40/1] scant of a group of expectal a LC_m is used in the FBS in

tergenisms. The LCm re version accessing access texticity.

LDm (lethel does, 50 percent): Does of a substance that lefts 50 percent of a group or a substance. The LDm is used in the longer of the l exposed expenium. The LD₀ is used in the 1955 in essenting scale tracicity [milligrams terricust per kilogram body weight [mg/kg]].

Maximum Conteminant Lovel (MCL):
Under section 1412 of the Safe Drinking

Water Act, as emended, the maximum permissible concentration of a substance in oter that is delivered to any user of a public

trator supply.

Maximus: Conteminent Level Goal (MCLG): Under section 1412 of the Sele Detelding Water Act, se amended, a reachle concentration for a substance in drinking water that is protective of adverse human health effects and alleves an adequate

in of enlisty.

wheel Detection Limit (MDL): Lorent concentration of analyte that a method can detect reliably in either a sample or blank.

Mined redisactive and other hazardous sufferences: Meterial containing both radioactive hazardone substances and accordinactive hazardous substances. spardless of whether these types of shotmess are physically separated, makined chamically, or simply mixed de.

National Ambient Air Quality Standard (NAAQS): Primary standards for air qua established under sections 108 and 108 of the

Class Air Act, as amended.
National Emission Standards for Hanardous Air Pollutunts (NESHAPs): adards established for substances lists under section 112 of the Clean Air Act. on amended. Only these NESHAPs prounleste in ambient concentration units apply in the HES.

nol-water partition coefficient (K., for If: Measure of the urbent of partitioning of a substance between water and octaes! at equilibrium. The K_{ee} is determined by the ratio between the concentration in octanol divided by the concentration in water at equilibrium. [unitless].

Organic carbon partition coefficient (Ker): Measure of the extent of partitioning of a

a. et eq substance, at equilibries, between expensic conten in geologic materials and water. The higher the K_{ee}, the more Mady a substance is ofe materials than to remain

Abstance caused by direct absorption of the energy (direct photolysis) or caused by ther substances that absorb soler energy other substances that about soler energy (indirect photolysis).

Realistion: Particles (alpha, bota, neutrons) or photons (is- and gamma-rays) emitted by tediamacides.

Andioactive decay: Procum of spontaneous prince transformation, whereby on isotope i one alument is transformed into an isotope

of one classest is benefitzened into an score of another element, releasing excess energy in the form of reliation.

Another classified Time required for one-half the atoms in a given questiny of a inactific redisconcilide to undergo radioactive

ducay.

Andinective substance: Solid, liquid, or gas custaining atoms of a single radionuclide or multiple radionuclide.

Budioactivity: Property of those isotopes of

ladioactivity: Property of those isotopes of ments that exhibit redisactive decay and نابع الد

out rediction.

Andicouclide/redictorape: lectope of an element orbitate; redicatelying. For HRS purposes, "redicatelyide" and "redictorape" ----

Reference dose (RAD): Betimete of a daily weather level of a substance to a human colds effects are not unferpated. [militarene

olth effects are not unficipated. [milligrams elecant per lifegons body weight per day gftsp-day]]. Removed oction: Action, that somewas musicus asketmoss from the alle for proper ool or destruction in a facility po under the Resource Consurvation and Recovery Act or the Toxic Substances Cantral Act or by the Nacious Regulatory

quals that amount was a superior into caterying a disting of 1 electrostofic sulf (one) in 1 cubic masses of day six under standard conditions. One microsomban (e.R.) equals

Sample quantitation liter (Supp.)
a substance that can be reasonably partition given the limits of detection for the of a c notheds of analysis and sample characteristics that may affect quantitation (for example, disting, concentration).

g concentration: Media-specific mark concentration for a hexardous ace that is used in the HRS for comparison with the concentration of that bacardone substance in a sample from that madis. The screening concentration for a specific hexandeus substance corresponds to its selesance door for inhelation exposures or for east exposures, as appropriate, and, if the reductors is a human conclusion with a weight-of-evidence classification of A. B. or C. to that concentration that corresponds to its 10⁻⁶ individual lifetime excess cancer risk for inhabition exposures or for oral exposures, as appropriate.

Site: Area(s) where a hazardous substance has been deposited, stored, disposed, or placed, or has otherwise come to be located. Such areas may include multiple sources and may include the area between sources.

Suope factor (also referred to as cance potency factor): Estimate of the probability of response (for example, cancer) per unit intake of a substance over a lifetime. The slope factor is typically used to estimate upper-bound probability of an individual developing cancer as a result of exposure to a particular level of a human carcinogen with a weight-of-evidence classification of A. B. or C. [[mg/kg-day]" for non-radioactive substances and (pC_i)-1 for radioactive substances).

Source: Any area where a hazardous substance has been deposited, stored. disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. Sources do not include those volumes of air, ground water, surface water, or surface water sediments that have become contaminated by migration, except: in the case of either a ground water plum with no identified source or contaminated surface water sediments with no identified source, the plume or contaminated sediments may be considered a source.

Target distance limit: Maximum distance over which targets for the site are evaluated. The target distance limit varies by HRS pathway.

Uranium Mill Tailings Radiation Control Act (UMTRCA) Standards: Standards for radionuclides established under sections 102. 104, and 108 of the Uranium Mill Tailings Radiation Control Act, as amended.

Vapor pressure: Pressure exerted by the vapor of a substance when it is in equilibrium with its solid or liquid form at a given temperature. For HRS purposes, use the value reported at or near 25° C. Jatmosphere or torri.

Volatilization: Physical transfer process through which a substance undergoe change of state from a solid or liquid to a gas.

Water solubility: Maximum concentration of a substance in pure water at a given temperature. For HRS purposes, use the value reported at or near 25° C. [milligrams per liter (me/l)].

Weight-of-evidence: EPA classification system for characterizing the evidence supporting the designation of a substance as a human carcinogen. EPA weight-of-evidence groupings include:

Group A: Human carcinogen--sufficient evidence of carcinogenicity in humans. Group B1: Probable human carcinogen-limited evidence of carcinogenicity in bumans.

Group B2: Probable human carcinogen-sufficient evidence of carcinogenicity in animals.

Group C: Possible human carcinogen-limited evidence of carcinogenicity in animals.

Group D: Not classifiable as to human carcinogenicity--applicable when there is no animal evidence, or when human or animal evidence is inadequate. Group E: Evidence of noncarcinogenicity for humans.

2.0 Evaluations Common to Multiple **Pathways**

2.1 Overview. The HRS site score (S) is the result of an evaluation of four pathways:

· Ground Water Migration (Sp.).

Surface Water Migration (S...).

· Soil Exposure (S.).

· Air Migration (S.).

The ground water and air migration pathways use single threat evaluations, while the surface water migration and soil exposure pathways use multiple threat evaluations. Three threats are evaluated for the surface water migration pathway: drinking water, human food chain, and environmental. These threats are evaluated for two separate migration components--overland/flood migration and ground water to surface water migration. Two threats are evaluated for the soil exposure pathway: resident population and nearby population.

The HRS is structured to provide a parallel evaluation for each of these pathways and threats. This section focuses on these parallel evaluations, starting with the calculation of the HRS site score and the individual pathway scores.

2.1.1 Calculation of HRS site score. Scores are first calculated for the individual pathways as specified in sections 2 through 7 and then are combined for the site using the following root-mean-square equation to determine the overall HRS site score, which ranges from 0 to 100:

$$S = \sqrt{\frac{S_{gw}^2 + S_{gw}^2 + S_{g}^2 + S_{g}^2}{4}}$$

2.1.2 Calculation of pathway score. Table 2-1, which is based on the air migration pathway, illustrates the basic parameters used to calculate a pathway score. As Table 2-1 shows, each pathway (or threat) score is the product of three "factor categories": likelihood of release, waste characteristics. and targets. (The soil exposure pathway uses likelihood of exposure rather than likelihood of release.) Each of the three factor categories contains a set of factors that are assigned numerical values and combined as specified in sections 2 through 7. The factor values are rounded to the nearest integer, except where otherwise noted.

2.1.3 Common evaluations. Evaluations common to all four HRS pathways include:

· Characterizing sources.

-Identifying sources (and, for the soil exposure pathway, areas of observed contamination [see section 5.0.1]].

-Identifying hazardous substances associated with each source (or area of observed contamination).

-Identifying hazardous substances available to a pathway.

TABLE 2-1.—SAMPLE PATHWAY SCORESHEET

Factor category	Maxi- mum value	Value as- signed
Likelihood of Release		\
1. Observed Release	550	
2. Potential to Release	500	Ì
3. Likelihood of Release (higher of lines 1 and 2)	550	
	330	i
Waste Characteristics		1
4. Toxicity/Mobility	(a)	•
6. Waste Characteristics	(a) 100	١.
		`
Targets		i
7. Negrest Individual	50	!
7a. Level I	50 45	İ
7c. Potential Contamination	20	
7d. Hearest individual (higher of		i
lines 7a, 7b, or 7c)	50	i
8. Population		ļ
82. Lovel 1	(p)]
6b. Level II		1
Sc. Potential Contamination	(p)	i
8d. Total Population (lines 8a+8b+8c)	(b)	ł
9. Resources	5	Í
10. Sensitive Environments	(b)	1
10g. Actual Contamination	(b)	!
10b. Potential Contamination	(b)) ;
10c. Sensitive Environments		ļ
(lines 10a+10b)	(p)	1
11. Targets (lines 7d+8d+9+10c)	(b)	•

12. Pathway Score is the product of Likelihood of Release, Waste Characteristics, and Targets, divided by 82,500. Pathway scores are limited to a manamum of 100 points.

* Maximum value applies to waste characteristics category. The product of lines 4 and 5 is used in Table 2-7 to derive the value for the waste characteristics factor category.

* There is no limit to the human population or sensitive environments factor values. However, the pathway some based solely on sensitive environments is limited to a maximum of 60 points.

- Scoring likelihood of release (or likelihood of exposure) factor category.
 - -Scoring observed release (or observed contamination).
 - Scoring potential to release when there is no observed release.
- Scoring waste characteristics factor category.

-Evaluating toxicity.

- -Combining toxicity with mobility. persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential, as appropriate to the pathway (or threat).
- Evaluating hazardous waste quantity. -Combining hazardous waste quantity with the other waste characteristics factors.
- -Determining waste characteristics factor category value.
- Scoring targets factor category.
- -Determining level of contamination for targets.

These evaluations are essentially identical for the three migration pathways (ground water, surface water, and air). However, the

ations differ in cartain respects for the sell expenses pollowy.
Section 7 op cities modifications that apply

to each pathway when evaluating sites containing redirective substances. Section 2 focuses on evaluations cons

at the pethody and threat levels. Note that for the ground water and entires water for the ground water and savager waves neignation polyman, separate somes are calculated for each squifer (see section 3.8) and each watershed (see sections 4.13.3 and 4.2.1.5) when determining the polymay source for a also. Although the evolutions in section 4.2.1.5) whith afternooning the primary income for a afte. Although the evolutions in section 2 do not very when different appliers or vestershods one scaned at a site, the specific factor values (for example, observed release.

nations and household waste quart Household grantly:

, Source ...

A -----

bezardous waste questify, toxicity/mobility) that result from the ? evaluations can vary by aquifor and by watershed at the site. This oy aquate through differences both in the specific sources and territors eligible to be evaluated for each aquifer and westershed and in whother observed releases can be established for each aquifer and watershed. Such differences in scoring at the aquifer and watershed level are addressed in sections 3 and 4. not section 2.

- 2.2 Characterize sources. Source syctorization includes identification of the inflowing
- * Seasons (and arens of observed contamination) at the site.

- · Happrolyne substances accociated with these sources (or topos of observed -
- Polimeys policifely threatened by

Table 3-2 presents a sample workshort for وأوال والمرابعة

2.2.1 Identify sources. For the three migration policyty, identify the sources of the sile that controls hazardous substances. Identify the migration pulmony(s) to which each source applies. For the soil exposure policyty, identify separ of observed nation at the site (see section 5.6.1).

TABLE 2-2-SAMPLE SOURCE CHARACTERIZATION WORKSHEET

Hazardans wastestream quartity:	-						-
Volume						-	
Ares						-	
Area of choused contentioning	-						
S. Hamilton substances associated with th	100 TOL					_	
			A	maintée la paire	₹		
Hamadous substance		lie .		Surface	(PA)	So	•
•	Ges	Personale	(GM)	Orestand/ Secial	GW to SW	Resident ·	Nearby
· ·							
					1		
					T		

2.2.2 Identify hexaptions substances reaction with a source. For each of the re migration potheraps, consider these arrious substances documented in a se (for example, by sampling, labels fasts, exal or wallton statements) to sents) to be cioted with that source when evaluating ch pothway. In some instances, a tance can be documented as **#** 8 being present at a site flar example, by labels, manifests, eral or written statem e specific source(s) containing that show substance counst be documen Por the three migration pothways, in those instances when the specific seaso(s) cannot be decremented for a bounders substance. does substance to be consider the home ment in each source at the site, except moss for which definitive information licutes that the integritous solutance w indicates that the hazardous not or could not be present. us substance was

ter self expenses y nees that meet the criteria for observed contemination for that that area when evaluating the pathway.

2.2.3 Identify honorches substances available to a pathway. In evaluating each

migration pathway, consider the following hazardous substances available to migra from the sources at the site to the patieway:

- Ground water migration.
 - -Housedous substances that meet the criteria for an observed release (see section 2.3) to ground water.
 - All hazzadous subbtances associated with a source with a ground water containment factor value greater than 0 (see section 3.1.2.1).
- · Surface water migration-overland/flood
 - -Hazardous substances that meet the criteria for an observed release to surface water in the watershed being evaluated.
 - -All herardous substances associated with a source with a surface water containment factor value greater than 6 for the watershed (see sections 4121211 and 4121221).
- · Surface water migration—ground water to surface water component.
 - -Hazardous substances that meet the criteria for an observed release to ground water.

- All bear ices associati with a source with a ground water containment factor value groater than 0 (see sections 42212 and \$1.21).
- Air migration.
 - -Histordous substances that meet the criticia for an observed release to the
 - atmosphere. All gascous beautious substances associated with a sparce with a gas containment factor value greater than 0 (see section 6.1.2.1.1).
- -All particulate hazardous substances associated with a source with a perticulate containment factor valgreeter than 0 (see section 6.1.2.2.1).
- · For each migration pathway, in those stances when the specific source(s) ntaining the hazardous substance cannot focumented, consider that hexardous stance to be available to migrate to the pathway when it can be associated (see section 2.2.2) with at least one source having a containment factor value greater than 0 for that puthpray.

In evaluating the sail exposure pathway, consider the following hazardous substances available to the pathway:

- Soil exposure—resident population threat
 - -All hazardous substances that meet the criteria for observed contamination at
 - the site (see section 5.0.1). Soil exposuse—nearby population threat.
 - -All hazardous substances that meet the criteria for observed contamination at areas with an attractiveness/ accessibility factor value greater than 0 (see section 5.2.1.1).

2.3 Likelihood of release Likelihood of release is a measure of the likelihood that a waste has been or will be released to the environment. The likelihood of release factor category is assigned the maximum value of 550 for a migration pathway whenever the criteria for an observed release are met for that pathway. If the criteria for an observed release are met, do not evaluate potential to release for that pathway. When the criteria for an observed release are not met, evaluate potential to release for that pathway, with a maximum value of 500. The evaluation of potential to release varies by migration pathway (see sections 3, 4 and 6).

Establish an observed release either by direct observation of the release of a hazardous substance into the media being evaluated (for example, surface water) or by chemical analysis of samples appropriate to the pathway being evaluated (see sections 3, 4. and 6). The minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level. Further, some portion of the release must be attributable to the site. Use the criteria in Table 2-3 as the standarcfor determining analytical significance. (The criteria in Table 2-3 are also used in establishing observed contamination for the soil exposure pathway, see section 5.0.1.) Separate criteria apply to radionuclides (see section 7.1.1).

TABLE 2-3.—OBSERVED RELEASE CRITERIA FOR CHEMICAL ANALYSIS

le Messurement < Sample Quantitation

No observed release is established. o Measurement > SAMPLE QUANTITATION

An observed release is established as follows:

- If the background concentration is not detecte (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds the sample quantite. tion limit.
- If the background concentration equals or exceeds the detection limit, an observed release is established when the sample measur times or more above the background concentra-
- * If the sample quantitation limit (SQL) cannot be stablished, determined if there is an observed release as follows:

e de la Marie de Caracteria de la Caract

—If the sample analysis was performed under the EPA Contract Laboratory Program, use the EPA contract-enquired quent tation .mit (CROL) in place of the SOL

mple analysis is not performed under the EPA Contract Laboratory Program, use the detection limit (OL) in place of the SQL.

2.4 Waste characteristics. The waste characteristics factor category includes the following factors: hazardous waste quantity, toxicity, and as appropriate to the pathway or threat being evaluated, mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential.

2.4.1 Selection of substance potentially posing greatest hazard. For all pathways (and threats), select the hazardous substan entially posing the greatest hazard for the pathway (or threat) and use that substance in evaluating the waste characteristics category of the pathway (or threat). For the three migration pathways (and threats), base the ction of this hazardous substance on the toxicity factor value for the substance, combined with its mobility, persistence, and/ or bioaccumulation (or ecosystem bioaccumulation) potential factor values, as applicable to the migration pathway (or threat). For the soil exposure pathway, base the selection on the toxicity factor alone.

Evaluation of the toxicity factor is specified in section 2.4.1.1. Use and evaluation of the mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential factors vary by pathway (or threat) and are specified under the appropriate pathway (or threat) section. Section 2.4.1.2 identifies the specific factors that are combined with toxicity in evaluating each pathway (or threat).

24.1.1 Toxicity factor. Evaluate toxicity for those bazardous substances at the site that are available to the pathway being scored. For all pathways and threats, except the surface water environmental threat. evaluate human toxicity as specified below. For the surface water environmental threat. evaluate ecosystem toxicity as specified in section 4.1.4.2.1.1.

Establish human toxicity factor values based on quantitative dose-response parameters for the following three types of toxicity:

 Cancer -- Use slope factors (also referred to as cancer potency factors) combined with weight-of-evidence ratings for carcinogenicity. If a slope factor is not available for a substance, use its ED₁₀ value to estimate a slôpe factor as follows:

Slope factor
$$=\frac{1}{6 \text{ (ED}_{to)}}$$

 Noncancer toxicological responses of chronic exposure--use reference dose (RfD)

THE RESERVE OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TO THE PERSON NAMED IN

 Noncancer toxicological responses of acute exposure--use acute toxicity parameters, such as the LD-

Assign human toxicity factor values to a hazardous substance using Table 2-4, as follows

 If RfD and slope factor values are both available for the hazardous substance, assign the substance a value from Table 2-4 for each. Select the higher of the two value assigned and use it as the overall toxicity factor value for the hazardons substance.

· If either an RfD or slope factor value is available, but not both, assign the hazardous substance an overall toxicity factor value from Table 3-4 based solely on the available value (RfD or slope factor).

. If neither an RfD nor slope factor value is available, assign the hazardous substance an overall toxicity factor value from Table 2-4 based solely on acute toxicity. That is, consider acute toxicity in Table 2-4 only when both RfD and slope factor values are not available.

 If neither an RfD, nor slope factor, nor acute toxicity value is available, assign the hazardous substance an overall toxicity factor value of 0 and use other hazardous substances for which information is available in evaluating the pathway.

TABLE 2-4.--TOXICITY FACTOR EVALUATION

Chronic Toxicity (Hum

Reference dose (RfD) (mg/kg-day)	Assigned value
RID < 0.0005	10,000
0.005 ≤ RfD < 0.05 0.05 ≤ RfD < 0.5	100
0.5 ≤ RIDRID not available	1 0

Weight-of-evidence*/slope factor (mg/ lig-day)**1			Assigned
٨	8	С	value
0.5 ≤ SP	5 ≤ SF	50 ≤ SF	10,000
0.05 ≤ SF < 0.5	0.5 ≤ SF < 5	5 ≤ SF < 50	1,000
SF < 0.05	0.05 ≤ SF < 0.5	0.5 ≤ SF < 5	100
	SF < 0.05	SF < 0.5	10
Slope factor not available.	Slope - factor not available.	Slope factor not available.	0

^{*}A, B, and C refer to weight-of-evidence categories. Assign substances with a weight-of-evidence category of D (nadequate evidence of carcinogenicity) or E (evidence of tack of carcinogenicity) a value of 0 for carcinogenicity.

*SF = Slope factor.

TABLE 2-4.—TOXICITY FACTOR EVALUATION—CONCLUDED

Acute Toxicity (Human)

Coal Life, (mg/fug)	Dynami Lib _{er} (mg/hg)	Dust or mint i.C., (seg-1)	Gas er vapor LC _{in} (ppm)	Assigned value
90 5 LD < 990	20 5 LD < 200	0.2 ≤ LCm < 2		1,000 100 10 10 1

If a tunicity factor value of 0 is assigned to I honorless substances sectiohie to a 41 ray (that is, insufficient e available for evaluating all Sede pel d, use a defined value of 190 s n tericity factor value for all mass evellable to the g. For house and experiences parely ong. For homestus enterances arving to tenticity data for multiple exposure to fire example, inhabition and then, counties all exposure rester and he highest easigned value, regardless of al contide linkest and n seale, or the tenticity factor wale

species remains a seligh box For EBS purposes, assign box and had (and its compounds) a safety factor value of 20,000. une, andja both arbestus composado) a human

parate calenta apply for assigning factor is for human toxicity and occupates ricity for radioanciides (see sections 7.2.1 727

of 7.23,

2.6.1.2 Houselous substance solection.

It each baseslous substance evaluated for
infgution patienty (or thread, coupline the
man taxicity factor value (or occupation
addity factor value) for the horsedone
between with a mobility, persistence, and/ Per each h n (or occupation notestical factor value as -later) prin

- Cround water migration.
- Determine a combined human training/ mobility factor value for the hexardous phylinese fees section 200 n micky ce feet section 1211
- Surface water migration-overland/flood
 - -Determine a combined human texticity/ istence factor value for the آبد ہ nace for the drinking ster these (see section 41.2.2.1).
 - ableed homes texicity/ necessaristics factor erados sabe ales for the la acz fer m food chain threat (see (1171)
 - and econysten 22 600 nticity/persistence/blooccamiletion stor value for the assertion chr w ace for the anvironmental threat (see section 41.42.1).
- Surface water migration-ground water to effect water migration component.
 - -Determine a combined human testicity/ mobility/possistance factor value for the instantous substance for the drinking water threat face section 42221
 - -Determ ne a combined human toxicity! mobility/persistence/bioaccumulation factor value for the hazardoss because for the human food chair. threat (see section 4.2.3.2.1)

- \$ 0 COM tericity/mobility/persistes bioaccumulation factor value for the urdous substance for the svironmental threat (see section 42421)
- Air migration

-Determine a combined human toxicity/ mobility factor value for the hexardous substance (see section 6.2.1).

e each combined factor value for exardous substance by multiplying th individual factor values appropriate to the vey (or threat). For each migratic up (or threat) being evalu rue substance with the high ed factor value and use that substance g the waste characteristics factor my of the pathway (or timest).

e sell expense pathway, select these substance with the highest less daway, select the nicity factor value from smong the some that most the criteria for observed sinution for the threat evaluated and e that substance in evaluating the waste characteristics factor catagory.

2.4.2 Haunrdous weste que ncity. Evalu e hozardous waste quantity factor by first igning each source (or area of observed rianj a source bazardous waste country value as specified below. Sum these takes to obtain the hazardons waste quantity factor value for the pathway being

In evaluating the hazardous weste quantity: factor for the three migration pathways. allocate husardous substances and hazardone westestreams to specific sources in the manner specified in section 2.2.2, except consider-hazardous substances and as wastestreams that cannot be allocated to any specific source to constitute Bocated source" for purpose of evaluating only this factor for the three igration pathways. Do not, however. include a hazardous substance or hazardous wastestroom in the unaillocated source for a migration pathway if there is definitive information indicating that the substance or wastestream could only have been placed in sources with a containment factor value of 0 for that migration pathway.

sating the hazardous waste quantity factor for the soil exposure pathway, ellecat to each area of observed contamination only those hazardous substances that meet the criteria for observed contamination for that area of observed contamination and only those hazardous wastestreams that contain bazardous substances that meet the criteria for observed contamination for that area of

observed contemination. Do not consist other beautious substances or beauti name at the alte in eval

factor for the cell expenses poliving.

2.4.2.1 Source insuratous waste quantity. For each of the those migration pathways assign a source bazardous waste quantity s waste quantity also to each source (including the allocated source) having a or factor value greater than 0 for the path being evaluated. Consider the window R carp rce to have a containment factor value rester then 0 for each migration pathway. For the sell exposure pathway, assign a burey.

source busicious waste quantity value to each case of observed contamination, as Scable to the threat being evaluated.

For all pullways, evaluate source rer or paramy, eventur sure the following sermelous weste quantity using the following or measures in the following Metarchy:

• Hammious constituent quantity.

• Hammious westestreen quantity.

- Ame.

For the mullicented source, use only the first two measures.

rat two measures.

Separate culturin apply for entigning a surce homedras weste quantity value for ediamelides (see section 7.2.5).

2.4.2.1.1 Homedras constituent quantity.

Evaluate hexardens constituent quantity for the source (or area of observed contactionica) bosed solely on the most of CERCIA bezardous substances (as deficed in CERCLA section 165(14), as execuded) affected to the source for area of observed

- ntessination), except Per a hazzadore wee rests listed pursured to section 300; of the Solid Waste Disposal Act.
 as anomaled by the Resource Conservation and Recovery Act of 1870 (RCRA), 42 U.S.C. M of seq., determine Hs mass for the evaluation of this measure as follows:
 - -If the hazardous wante is listed solely for Hozard Code T (toxic waste). include only the mess of constituents in the hazzarlous waste that are CERCLA hazzarlous substances and not the mass of the entire hazardous
 - -If the hexardous waste is listed for any other Hasard Code (including T plus any other Hasard Code), include the mass of the entire bezerdous waste.
- · For a RCRA hazardous waste that exhibits the characteristics identified usile: section 3001 of RCRA, as accended. determine its mass for the evaluation of this measure as foliotes:

-if the hazardous waste exhibits only the characteristic of toxicity (or only the characteristic of EP toxicity), include only the mass of constituents in the hazardous waste that are CERCLA hazardons substances and not the mass of the entire hazardous waste. -If the hazardous waste exhibits any other characteristic identified under section 3001 (including any other characteristic plus the characteristic of toxicity for the characteristic of EP toxicity]), include the mass of the entire hazardous waste.

Based on this mass, designated as C, assign a value for hazardous constituent quantity as follows:

- For the migration pathways, assign the source a value for hazardous constituent quantity using the Tier A equation of Table
- · For the soil exposure pathway, assign the area of observed contamination a value using the Tier A equation of Table 5-2 (section

If the hazardous constituent quantity for the source (or area of observed contamination) is adequately determined (that is, the total mass of all CERCLA hazardous substances in the source and releases from the source [or in the area of observed contamination] is known or is estimated with reasonable confidence), do not evaluate the other three measures discussed below. Instead assign these other three measures a value of 0 for the source (or area of observed contamination) and proceed to section 2.4.2.1.5.

If the hazardous constituent quantity is not adequately determined, assign the source (or area of observed contamination) a value for hazardous constituent quantity based on the available data and proceed to section 242T2

TARLE 2-5 -- HAZARDOUS WASTE QUANTITY EVALUATION EQUATIONS

Tier	Measure*	Units	Equation for assigning value*
A	Hazardous	lb.	С
	constituent		ļ
В.	quentity (C)	_	
13 °	Hazardous wastestrage	1b	W/5,000
	quantity (W)		1
C.	/alume (V)		i
	Landill	yďa	V/2,500
	Surface	yde	V/2.5
	impoundment Surface	yďs	V/25
-	impoundment	70.	1/25
	(buried/backfilled)	ĺ	1
	Drums "	gallon	V/500
	Tanks and	yd²	V/2.5
	containers other	ł	ł
	than drums Contaminated soil	yd³	V/2,500
	Pile	yd ³	V/2.5
	-Other	yda	V/2.5
E) t	Area (A)	ľ	ļ
	Landil	ft²	A/3,400
	Surface	ft²	A/13
	'mpoundment'	ſ	1

TABLE 2-5 .-- HAZARDOUS WASTE QUAN-TITY EVALUATION EQUATIONS—Concluded

Tier	Measure	Units	Equation for assigning value *
	Surface impoundment . &buried/	₩2	· A/13
	backfilled) Land treatment Pile 4 Contaminated soil	#* #*	A/270 A/13 A/34,000

* Do not round to meanest integer. *Convert volume to mean when necessary: 1 to=2,000 pounds=1 cubic yard=4 drums=200 gallons.

1 dram=50 gatons.

4 Use land surface area under pile, not surface area of pile.

2.4.2.1.2 Hazardous wastestream quantity. Evaluate hazardous wastestream quantity for the source (or area of observed contamination) based on the mass of hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants (as defined in CERCLA section 101[33], as amended) that are allocated to the source (or area of observed contamination). For a wastestream that consists solely of a hazardous waste listed pursuant to section 3001 of RCRA, as amended or that consists solely of a RCRA hazardous waste that exhibits the characteristics identified under ection 3001 of RCRA, as amended, include the mass of that entire hazardous waste in the evaluation of this measure

Based on this mass, designated as W, assign a value for hazardous wastestream quantity as follows:

 For the migration pathways, assign the source a value for hazardous wastestream quantity using the Tier B equation of Table

. For the soil exposure pathway, assign the area of observed contamination a value using the Tier B equation of Table 5-2 (section 5.1.2.2).

Do not evaluate the volume and area measures described below if the source is the unallocated source or if the following condition applies:

 The hazardous wastestream quantity for the source (or area of observed contamination) is adequately determinedthat is, total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source (or for the area of observed contamination) is known or is estimated with reasonable confidence.

If the source is the unallocated source or if this condition applies, assign the volume and area measures a value of 0 for the source (or area of observed contamination) and proceed to section 2.4.2.1.5. Otherwise, assign the source (or area of observed contamination) a value for hazardous wastestream quantity based on the available data and proceed to section 2.4.2.1.3.

2.4.2.1.3 Volume Evaluate the volume measure using the volume of the source (or the volume of the area of observed

contamination). For the soil exposure pathway, restrict the use of the volume measure to those areas of observed contamination specified in section 5.1.2.2.

Based on the volume, designated as V, assign a value to the volume measure as follows:

· For the migration pathways, assign the source a value for volume using the appropriate Tier C equation of Table 2-5.

For the soil exposure pathway, assign the area of observed contamination a value for volume using the appropriate Tier C equation of Table 5-2 (section 5.1.2.2).

If the volume of the source (or volume of the area of observed contamination, if applicable) can be determined, do not evaluate the area measure. Instead, assign the area measure a value of 0 and proceed to section 2.4.2.1.5. If the volume cannot be determined (or is not applicable for the soil exposure pathway), easign the source (or area of observed contamination) a value of 0 for the volume measure and proceed to section 2.4.2.1.4.

2.4.2.1.4 Area. Evaluate the area measure using the area of the source (or the area of the area of observed contamination). Based on this area, designated as A, assign a value to the area measure as follows:

· For the migration pathways, assign the source a value for area using the appropriate Tier D equation of Table 2-5.

· For the soil exposure pathway, assign the area of observed contamination a value for area using the appropriate Tier D equation of Table 5-2 (section 5.1.2.2).

2.4.2.1.5 Calculation of source hazardous waste quantity value. Select the highest of the values assigned to the source (or area of observed contamination) for the hazardous constituent quantity, hazardous wastestream quantity, volume, and area measures. Assign this value as the source hazardous waste quantity value. Do not round to the nearest

2.4.2.2 Calculation of hazardous waste quantity factor value. Sum the source hazardous waste quantity values assigned to all sources (including the unallocated source) or areas of observed contamination for the pathway being evaluated and round this sum to the nearest integer, except if the sum is greater than 0, but less than 1, round it to 1. Based on this value, select a hazardous waste quantity factor value for the pathway from Table 2-6.

TABLE 2-6.-HAZARDOUS WASTE QUANTITY FACTOR VALUES

Hazardous waste quantity value	Assigned value
0	0
Greater than 180 to 10,000	_100 10,000 1,000,000

"If the hazardous waste quantity value is greater than 0, but less than 1, round it to 1 as specified in

⁸ For the pathway, if hazardous constituent quanti-ty is not adequately determined, assign a value as specified in the text; do not assign the varue of 1.

Table 2-6# X Tox (Mobilety)

* Shewlook up X in Tab

For a migration partitives, if the hexardors suctional quantity is adequately standard (see section 2.4.2.1.1) for all emined (see section 2.4.2.1.1) for all score (or all portions of sources and store manifold after a source) action), (so the value form Table 2-6 as the surface water quantity factor value for the lower. If the hazardous constituent stilly is not adequately determined for one store reurous for box or more portions of space or subscious remaining after a removal into section of first action. nomicas or releases regressing after a re-action) assign a factor value as follows:

action) easign a factor value as follows:

• If any target for that migration position is subject to Level I or Level II concentrations easien 2.5), easign other the value for Table 2-6 or a value of 100, whichever is proster, so the beneathers weste quantity factor value for that pathway.

• If none of the tangets for that pathway subject to Level I or Level II concentration easign a factor value as follows: a project

e as fallence n a factor vi

- -If these has been so removed action, assign either the value from Table 3-6 or a value of 30, whichever is greater, --sies for that patherny.
- -If these has been a removed action: -- Determine values from Table 3-6
- with and without consideration of the property section.
- ration of the removal action repairment of the removal ac-weald be 200 or greater, assign either the wakes from Table 3-6 with consideration of the reages action or a value of 100, whiches is greater, as the hexacitous was reator, as the hazordous : utily factor value for the
- patiency.

 If the value that would be assigned from Table 3-6 without consideration of the someval action would be less than 100, assign a value of 10 as the homodour waste quantity factor value for the quantity (

For the sell expenses pathway, if the beauthour coordinant quantity is adequately determined for all coors of abserved contemination, assign the value from Table 2-6 or the beauthour wests quantity factor re. If the houselose extensional quanti adequately determined for one or man ءة والكهيمية الحيجة as of absenced contamination, and s of observed contentination, assign is the value from Table 2-6 or a value of 10. whichever is greater, as the hezerdous te quantity factor value.

24.3 Weste characteristics factor steptry value. Determine the waste structuristics factor and compary venus. Determine the waster characteristics factor category value as apacified in section 2.4.3.1 for all pothways and threats, except the surface water-human food chain threat and the surface waterntal threat. Determine the waste ereclaristics factor category value for these for two ferents as specified in section 2432

243.1 Pacter catagory voice. For the pathway (or threat) being evaluated, multiply the teology or combined factor value, as oppropriate, from section 2.4.1.2 and the rdous waste quantity factor value from se 2.4.2.2, subject to a maximum produc m product of 1×10°. Based on this waste characteristics product assign a waste characteristics factor

estagery value to the pathway (or threat) from Table 2-7.

TABLE 2-7.--WASTE CHARACTERISTICS FACTOR CATEGORY VALUES

Waste characteristics product	Assigned
0	
Greater then 0 to less than 10	
1×10° to has then 1×10°	
1 x 10° to less than 1 x 10°	
1×10° to less than 1×10°	- 2
1 x 10° to less than 1 x 10°	6 4 5
1 x 10° to fees then 1 x 10°	
1 x 1011 to less than 1 x 1012	5
TX10 ⁴⁸	1/im

2.4.3.2 Poster category value, consider inaccumulation potential. For the surface vater-human food chain thront and the stal throat, and the taxicity or combined factor value, as aprepriate, from section 24.1.2 and the hermitous waste quantity factor value from section 24.2.2. subject to:

 A maximum product of 1×10¹², and
 A maximum product exclusive of the

A distance processive in considering or ecosystem occumulation or ecosystem occumulation potential factor of 1×30°, seed on the total waste characteristics factor of the constant of the cons product, entigs a waste characteristics for category value to these threats from Table

2.5 Toronto.

The types of targets evaluated include the

- Rowleg.
 Individual (factor name varies by way and theet). Human populatio
- . Resources (these very by pathway and
- · Sensitive environments (included for all offereys except ground water migration).
 The factor values that may be assigned to

each type of target have the same ra pathway for which that type of target is sted. The factor value for most types of each pa targets depends on whether the target in subject to actual or potential contouries for the pediarry and whother the actual nation is Level I or Level It

 Actual coutant ation: Target is associated either with a patephing local that meets the criteria for an observed release (or observed contamination) for the athway or with an observed release based on direct observation for the pathway (additional criteria apply for establishing actual contamination for the human food cissin threat in the surface water mig peliway, see sections 41.3.3 and 42.33. sections I through 6 specify how to dete the targets associated with a sampling location or with an observed release based on direct observation. Determine whether the esteal contamination is Level I or Level II as laBours:

-Level I:

-- Media-specific concentrations for the target meet the critema for an

shoerved solones for observed tion) for the pathway and are at or above mode specific benchmark values. These henchmark values (see section 252) include both screening strations and concentrations offied in regulatory Smite (such Assistant Contaminant Level DACTI subset or

For the la man food chain threat in the englace water migration pathway, concentrations in tiess te from equatic hom n food ---minus are at ar above ak values, Such ti uples may be used in addition to media-specific concentrations only as specified in sections 4.1.3.3 and ecific concentrations only 4233

Level B

- Media-specific concentrations for the target meet the criteria for an pt means for our served scients for the pr ase (or observed ethway, but are has then mode upon uis. If some of the راجع بساست naces eligible to be necessaries surveneers against to be evaluated for the sampling location has an applicable benchmark, assign Level II to the actual contamination at the sampling beaten er
- For charred schoots based on direct observation, assign Level II to tangets as specified in sections 3. 4.004
- For the luman food chain threat in the surface water migration pudway, concentrations in tissue des from aquatic lum chain experient, when applicable, are below banchmark values. er b
- l'a target is subject to both Level I and Level II concentrations for a mediane for through evaluate the target using Lovel I concentrations for that brey (or threat).
- Potential contamination: Target is diject to a potential reloce (that is, target is at associated with actual contamination for

that pathway or theat).

Assign a factor value for individual risk as follows (select the highest value that applies to the pathway or threat):

" 30 points if any individual is exposed to

- Level I concentrations.

 45 points if any individual is exposed to Level II concents
- Maximum of 20 points if any individual subject to potential contrasination.

 Inc assigned is 20 scalinglied by the a. The cistance or dilution weight appropriate to the

Assign factor values for population and sensitive environments as follows:

- Sun Level I targets and multiply by 10.
 (Level I is not used for sensitive) sis bas systopes like sell at atsensesive Estion pathways.)
- Sum Level II torgets.
 Multiply potential targets by distance or dilution weights appropriate to the pathway. sam, and divide by 10. Distance or dilution weighting accounts for distribishing exposure

with increasing distance or dilution within the different pathways.

- Sum the values for the three levels.
 In addition, resource value points are assigned within all pathways for welfare-related impacts (for example, impacts to agricultural land), but do not depend on whether there is actual or potential contamination.
- contamination.

 2.5.1 Determination of level of octual contamination at a sampling location.

 Determine whether Level I concentrations or Level II concentrations apply at a sampling location (and thus to the associated targets) as follows:
- Select the benchmarks applicable to the pathway (or threat) being evaluated.
- Compare the concentrations of hazardous substances in the sample (or comparable samples) to their benchmark concentrations for the pathway (or threat), as specified in section 2.5.2.
- Determine which level applies based on this comparison.
- If none of the hazardous substances eligible to be evaluated for the sampling location has an applicable benchmark, assign Level II to the actual contamination at that sampling location for the pathway (or threat).

In making the comparison, consider only those samples, and only those hazardous substances in the sample, that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may also be used as specified in sections 4.1.3.3 and 4.2.3.3 of the surface water-human food chain threat. If any hazardous substance is present in more than one comparable sample for the sampling location, use the highest concentration of that hazardous substance from any of the comparable samples in making the comparisons.

Treat sets of samples that are not comparable separately and make a separate comparison for each such set.

- 2.5.2 Comparison to benchmarks. Use the following media-specific benchmarks for making the comparisons for the indicated pathway (or threat):
- Maximum Contaminant Level Goals (MCLGs)—ground water migration pathway and drinking water threat in surface water migration pathway. Use only MCLG values greater than 0.
- Maximum Contaminant Levels (MCLs)—ground water migration pathway and drinking water threat in surface water megration pathway.
- meration pathway.
 Food and Drug Administration Action
 Level (FDAAL) for fish or shellfish—human
 food chain threat in surface water migration
 pathway.
- pathway.

 EPA Ambient Water Quality Criteria (AWQC) for protection of aquatic life—environmental threat in surface water migration pathway.
- EPA Ambient Aquatic Life Advisory
 Concentrations (AALAC)—environmental
 threat in surface water migration pathway.
- National Ambient Air Quality Standards (NAAQS)—air migration pathway.
- National Emission Standards for Hazardous Air Pollutants (NESHAPs)—air migration pathway. Use only those NESHAPs promulgated in ambient concentration units. S. 4051999 0058(03)(13-DEC-90-11:23:26)

- Screening concentration for cancer corresponding to that concentration that corresponds to the 10⁻⁶ ir dividual cancer risk for inhalation exposures (air migration pathway) or for oral exposures (ground water migration pathway; drinking water and human food chain threats in surface water migration pathway; and soil exposure pathway).
- Screening concentration for noncancer toxicological responses corresponding to the RfD for inhalation exposures (air migration pathway) or for oral exposures (ground water migration pathway; drinking water and human food chain threats in surface water migration pathway; and soil exposure nathway).

Select the benchmark(s) applicable to the pathway (or threat) being evaluated as specified in sections 3 through 6. Compare the concentration of each hazardous substance from the sampling location to its benchmark concentration(s) for that pathway (or threat). Use only those samples and only those hazardous substances in the sample that meet the criteria for an observed release (or observed contamination) for the pathway. except: tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of any applicable hazardous substance from any sample equals or exceed its benchmark concentration, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If more than one benchmark applies to the hazardous substance, assign Level I if the concentration of the hazardous substance equals or exceeds the lowest applicable benchmark concentration.

If no hazardous substance individually equals or exceeds its benchmark concentration, but more than one hazardous substance either meets the criteria for an observed release (or observed contamination) for the sample (or comparable samples) or is eligible to be evaluated for a tissue sample (see sections 4.1.3.3 and 4.2.3.3), calculate the indices I and I specified below based on these hazardous substances.

For those hazardous substances that are carcinogens (that is, those having a carcinogen weight-of-evidence classification of A. B. or C], calculate an index I for the sample location as follows:

$$I = \sum_{i=1}^{n} \frac{C_i}{SC_i}$$

where:

- C, = Concentration of hazardous substance i in sample (or highest concentration of hazardous substance i from among comparable samples).
- SC_i=Screening concentration for cancer corresponding to that concentration that corresponds to its 10⁻⁶ individual cancer risk for applicable exposure (inhalation or oral) for hazardous substance i.
- n=Number of applicable hazardous substances in sample (or comparable samples) that are carcinogens and for which an SC₁ is available.

For those haxardous substances for which an RfD is available, calculate an index J for the sample location as follows:

$$\int_{i=1}^{m} \frac{C_{i}}{CR_{i}}$$

where

- C₁=Concentration of hazardous substance j in sample (or highest concentration of hazardous substance j from among comparable samples). CR₁=Screening concentration for noncencer
- CR, = Screening concentration for noncancer toxicological responses corresponding to RfD for applicable exposure (inhalation or oral) for hazardous substance j.
- m = Number of applicable hazardous substances in sample (or comparable samples) for which a CR, is available.

If either I or J equals or exceeds 1, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If both I and J are less than 1, consider the sampling location to be subject to Level II concentrations for that pathway (or threat). If, for the sampling location, there are sets of samples that are not comparable, calculate I and J separately for each such set, and use the highest calculated values of I and J to assign Level I and Level II.

See sections 7.3.1 and 7.3.2 for criteria for determining the level of contamination for radioactive substances.

3.0 Ground Water Migration Pathway

Evaluate the ground water migration pathway based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 3-1 indicates the factors included within each factor category.

Determine the ground water migration pathway score (S_{ww}) in terms of the factor category values as follows:

$$S_{pp} = \frac{(LR) (WC) (T)}{SF}$$

where:

- LR=Likelihood of release factor category value.
- WC=Waste characteristics factor category value.
- T=Targets factor category value. SF=Scaling factor.

Table 3-1 outlines the specific calculation

Calculate a separate ground water migration pathway score for each aquifer, using the factor category values for that aquifer for likelihood of release, waste characteristics, and targets. In doing so, include both the targets using water from that aquifer and the targets using water from all overlying aquifers through which the hazardous substances would migrate to reach the aquifer being evaluated. Assign the highest ground water migration pathway score that results for any aquifer as the ground water migration pathway score for the site.

BILLING CODE 8560-50-M

Likelihood of Release (LR)

Waste Characteristics (WC)

Targets (T)

Observed Release

or

Potential to Release

- . Containment
- . Not Precipitation
- . Depth to Aquifer
- · Travel Time

Toxicity/Mobility

· Toxicity

X

- . Chronic
 - Carcinogenio
 - Acute
- · Mobility
 - Water Solubility
 - Distribution

Coefficient (K_d)

Heserdous Waste Quantity

- Hazardous Constituent Quantity
- Hazardoue Wastestream Quantity
- · Volume
- · Area

Mearest Well Population

- · Level I Concentrations
- · Level II Concentrations
- Potential Contamination Resources

Wellhead Protection Area

FIGURE 3-1
OVERVIEW OF GROUND WATER MIGRATION PATHWAY

BILLING CODE sees-se-C

TABLE 3-1.--GROUND WATER MISSIATION PATHWAY SCORESHEET

Factor categories and factors	Market	Value
keliheod of Release to an Aquille:	1	1
1. Observed Relates	550	!
2. Potential to Release:	1	1
2a. Containment	. 10	I
2h. Net Precipitation	1 10	
2c. Depth to Aquiller	5	
2d. Travel Time	35	
2e. Potential to Release (lines 2s(2b+2c+2c))	Sco	
3. Likelihood of Release (Righer of lines 1 and 2a)	550	1 —.—
Paste Characteristics:	1	į
4. Toxicity/Mobility	(4)	1
5. Placardotts Weste Quantity		-
6. Waste Characteristics	(a) 148 100	I
argete:	7	1 -
7. Nassest Well	50	1
8. Probletion:	7	1 —
Sa. Level Concentrations	44	!
8b. Level II Concentrations	#) #) #) 5	i
8c. Potential Contamination		
8d. Population (lines 8a+8b+8c)		1
9. Resources	7 7	1
12. Welthard Protection Area	20	1
11. Targets (fines 7+94+9+10).		i —
round Water Maration Score for an Apulter:	7 "]
12. Aguiller Score (gines 3 x 8 x 11)/82,500) <	200	٠
round Water Migration Pathway Score;	7	-
13. Pathway Score (S_1, (highest value from line 12 for all aquillers evaluated)*	100	! _

- um value applies to wai um value not applicable round to nearest integr le cherecteristics category

3.0.1 General considerations

3.0.1.1 Ground water target distance limit. The target distance limit defines the maximum distance from the sources at the site over which targets are evaluated. Use a target distance limit of 4 miles for the ground

wrater migration pathway, except when aquifer discontinuities apply (see section 3.0.1.2.2). Furthermore, consider any well with an observed release from a source at the site [see section 3.1.1] to lie within the target distance limit of the site, regardless of the well's distance from the se

ell's distance from the sources at the site. For sites that consist solely of a contaminated ground water plume with no identified source, begin measuring the 4-mile target distance limit at the center of the area of observed ground water contamination. Determine the area of observed ground water contamination based on available samples that meet the criteria for an observed release.

3.0.1.2 Aquifer boundaries. Combine multiple aquifers into a single hydrologic unit for scoring purposes if aquifer interconnections can be established for these equifers. i: contrast, restrict aquifer boundaries if aquifer discontinuities can be established.

3.0.1.2.1 Aquifer interconnections Evaluate whether aquiler interconnections occur within 2 miles of the sources at the site. If they occur within this 2-mile distance, combine the aquifers having interconnections in scoring the site. In addition, if observed ground water contamination attributable to the sources at the site extends beyond 2 miles from the sources, use any locations within the limits of this observed ground water contamination in evaluating aquifer interconnections. If data are not adequate to establish aquifer interconnections, evaluate the aquifers as separate aquifers.

3.0.1.2.2 Aquifer discontinuities. Evaluate whether aquifer discontinuities occur within the 4-mile target distance limit. An equifer discontinuity occurs for scoring purposes only when a geologic, topographic, or other structure or feature entirely transects an aquifer within the 4-mile target distance limit, thereby creating a continuous boundary to ground water flow within this limit. If two or more aquilers can be combined into a single spic unit for scoring purpos aquifer discontinuity occurs only when the structure or feature entirely trans boundaries of this single hydrologic unit.

When an aquifer discontinuity is established within the 4-mile target distance limit, exclude that portion of the aquifer beyond the discontinuity in evaluating the ground water migration pathway. However, bezardous substances have migrated across an appearant discontinuity within the 4-mile target distance limit, do not consider this to

be a discontinuity in scoring the site.
3.0.1.3 Karst aquifer. Give a karst aquifer that underlies any portion of the sources at the site special consideration in the evaluation of two potential to release factors (depth to aquifer in section 3.1.2.3 and travel time in section 3.1.2.4), one waste characteristics factor (mobility in section 3.2.1.2), and two targets factors (nearest well in section 3.3.1 and potential contamination in section 3.3.2.4).

3.1 Likelihood of release. For an aquifer, evaluate the likelihood of release factor category in terms of an observed release factor or a potential to release factor.

3.1.1 Observed release, Establish an observed release to an aquifer by demonstrating that the site has released a hazardous substance to the aquifer. Base this demonstration on either

e meterial that Direct observation tains one or more hazardous substances has been deposited into or has been observed entering the aquifer.

 Chemical analysis—an analysis of round water samples from the aguifer adjectes that the concentration of hazardous en analysis of substance(s) has increased significantly bove the background concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release except: when the source itself consists of a ground water plume with no identified source, no separate attribution is required.

If an observed release can be established for the aquifer, assign the aquifer an observed release factor value of 550, enter this value in Table 3-1, and proceed to section 3.1.3. If an observed releas established for the aquifer; assign an observed release factor value of 0, enter this value in Table 3-1, and proceed to section 3.1.2

3.1.2 Potential to release. Evaluate potential to release only if an observed release cannot be established for the aquifer. Evaluate potential to release based on four factors: containment, net precipitation, depth to aquifer, and travel time. For sources overlying karst terrain, give any karst aquifer that underlies any portion of the sources at the site special consideration in evaluating depth to aquifer and travel time, as specified in sections 3.1.2.3 and 3.1.2.4.

3.1.21 Containment. Assign a containment factor value from Table 3-2 to such source at the site. Select the highest containment factor value assigned to those sources with a source hazardous waste quantity value of 0.5 or more (see section

2.4.2.1.9). (Do not include this minimum sine requirement in evoluting any other factor of this pathway.) Assign this highest value as the containment factor value for the equiler being evaluated. Enter this value in Table

If no course at the alte mosts the minimum size requirement, then select the highest value assigned to the sources at the size and

easign it as the containment factor value for the aquifer being evaluated. Enter this value in Table 3-1.

as 1 sote 3-1.

3.1.2.2 Net precipitation. Assign a net precipitation factor value to the site. Figure 3-2 provides computed net precipitation factor values, based on site location. Where necessary, determine the net precipitation factor value as follows:

 Determine mouthly precipitation and sentily evaporanepization:
 Use local measured mouthly averages.
 When local data are not available, use was seen each are not evaluate, at mentily averages from the inscrest Mational Occuragesphic and Atmospheric Administration weath n that is in a similar geographic

TABLE 3-2.—CONTABBILIENT FACTOR VALUES FOR GROUND WATER MIGRATION PATHWAY

Seuto	Assigned value	
All Control Charles And Control Control Charles and Tarket	-	
All Source (Except Surface Impoundments, Land Treatment, Containers, and Tarke)		
Gildens of Interaction adoptions originates from source grea (A., source area includes states and any	10	
conscional containment structures).	10	
th originas of harming autotions regular from source area, a lines, and	•	
(a) Name of the following property (1) analyticised engineered cover, or (2) functioning and maintained remove	10 .	
control system and small management system, or (3) functioning teachers collection and removal system	-	
invaluity duro but.		
(A) Any case of the Street Ingle September 1. (A) property 1. (A) Any case of the Street Ingle September 1. (A) An	7 .	
(c) Any two of the items in (d) present	\$	
(a) All Bosos in (A) greatest, plus no bulk or non-contained and liquids nor materials containing free liquids	<u>.</u> 3	
deposited in source grea.		
No evidence of homerbous explatance origination from source area, double finer with functioning franchista collection		
and removal system above and between forces, functioning ground water managing system, and		
(f) Only one of the following designations proposed to containment: (1) but, or necessariseless liquids or representation from materials described from Signific deposits in source area, or (2) no or necessarisation or representational numbers.	3	
on control system and hand management system, or (3) no or normalizational engineered cover.	•	
to have of the definition in the property	•	
Source area headle or under maketinged intext structure that provides protection from precipitation so that realities	•	
morall nor baschute is generated, lepids or transplate containing true lepids not deposited in tource area, and	•	
functioning and maintained non-on country property.	•	
Derive Improvious		
BAllmos of hazardous substance migration turns ourbons impoundment	10	

Fine highing present with other one diving, arrowed obling, or diving that its not requirely improceed and maintained	18	
No orliness of functions substance originalise from surface imprisonment, box Equick present, sound diving that is requirely imposted and applications, advanta boxboard, and	· · · · · · · · · · · · · · · · · · ·	
موال المعالم ا	•	
the Liner with functioning hypothetic collection and summed system below they, and functioning ground water	5	
mediating system.	_	
(1) Double first with functioning leachase collection and removed system between finers, and functioning ground	3 -	
meter manifesting ageleum. The originates of framesting application origination from surface impoundations and all two figures originated at	Surface price \$5 courses official faith on raffe	
chaters (Affect by removal of Equids or schillication of remaining weather and weath residents).	or too liquid deposited.	
Land Treatment		
		
Bildings of heardest substance migration from land treatment zone	•	
He entires of homeotres entertares enjoyees from land treatment agree and	. "	
(a) Functioning and maintained non-on control and named management system	7	
(N) Fundaming and registered run-on control and runoff improgramme system, and vegetative cover	5	
established over eating land produced area.	_	
(2) Land treatment area majoration in compliance with 40 CFR 284.280	•	

TABLE 3-2.—CONTAINMENT FACTOR VALUES FOR GROUND WAYER MIGRATION PARHWAY.—CONTINUED

Source	Assigned value
Containers	
V containers buriet	Evaluate voino All sources criteria.
Evidence of hezardous substance migration from container area (i.e., container area includes containers and any associated containment structures).	10
to liner (or no eccentially impervious base) under container area	•
to diving for no similar structural surrounding container sees.	10
Diving surrounding container area unaound or not regularly inspected and maintained	10
to evidence of hexardous substance migration from container area, container area aurounded by sound dilling	
that is regularly inspected and maintained, and:	
(a) Liner (or executelly impervious base) under container area	•
(b) Essentially impervious base under container area with liquide collection and removal system	7
(c) Containment system includes essentially impervious been, liquide collection system, sufficient capacity to	5
contain 10 percent of volume of all containers, and functioning and maintained run-on control; thus	
functioning ground water monitoring system, and splited or-leated hazardous substances and accumulated	
precipitation removed in timely meaner to prevent overflow of collection system, at least weekly inspection of	•
containers, hexardous substances in leaking or dateriorating containers transferred to containers in good condition, and containers seeled except when weets is added or removed.	
(d) Free liquids present, containment system has sufficient capacity to kold total volume of all containers and	
to provide adequate freeboard single liner under container area with functioning feachate collection and	
removal austern below liner, and functioning ground water monitoring system.	
(e) Same as (d) except: double liner under container area with functioning leachate collection and removal	3
system between liners.	
containers inside or under maintained intact structure that provides protection from precipitation so that neither runoil nor leachste would be generated from any unsealed or ruptured containers, liquide or materials	
containing free liquids not deposited in any container, and functioning and maintained run-off control present.	
to evidence of hexardous existence migration from container area, containers leaking, and all free liquids.	Evaluate using All sources criteria (with no bulk
eliminated at closure (either by removal of liquid or solidification of remaining westes and waste residues).	or tree liquid deposited.
Tank	r i
neigw-ground tens	Evaluate using All sources criteria.
vidence of bezardous substance migration from tank area (i.e., tank area includes tank, ancillary equipment	. 10
such as piping, and any associated containment structures).	
ank and ancillary equipment not provided with secondary containment (e.g., liner under tank area, vault system, double wells.	10
o diving for no similar structural surrounding tank and ancillary equipment.	10
ifting surrounding tank and incillary equipment untound or not regularly inspected and maintained	10
to evidence of hexardous substance migration from tank area, tank and ancillary equipment surrounded by	
sound diliting that is regularly inspected and maintained, and	
(a) Tank and excitory equipment provided with according containment	9
(b) Tank and ancillary equipment provided with secondary containment with teak detection and collection	7
system.	_
(c) Tank and ancillary equipment provided with secondary containment system that detects and collects spilled or leaked hezardous substances and accumulated precipitation and has sufficient especitly to contain 110	, 5
or named records accommon and incommon proclamatic and resident captures automated by the content of volume of furgest tank within containment area, solited or leaked buzzedous substances and	•
accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leaking or unfit-for-use tank systems promptly responded to, and functioning ground	
accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leaking or unlit-for-use tank systems promptly responded to, and functioning ground water reconlicting system.	_
accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leaking or uniti-for-use tank systems promptly responded to, and functioning ground water reconitoring system. (d) Containment system has sufficient capacity to hold volume of all tanks within tank containment area and to	5
accumulated precipitation removed in timely manner, at teast weekly inspection of tank and secondary containment system, all leaking or uniti-for-use tank systems promptly responded to, and functioning ground water recon	5
accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leaking or unlik-for-use tank systems promptly responded to, and functioning ground water resonlibring system. (d) Containment system has sufficient capacity to hold volume of all tanks within tank containment area and to provide adequate treatecard, single liner under that containment area with functioning leachate collection and removal system below liner, and functioning ground water monitoring system.	5
accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leating or unit-for-use tank systems promptly responded to, and functioning ground water monitoring system less sufficient capacity to hold volume of all tanks within tank containment area and to provide adequate freeboard, single liner under that containment area with functioning leachase collection and removal system below liner, and functioning ground water monitoring system. (e) Sente as (d) except: double liner under tank containment area with functioning leachase collection and	5 3
accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leaking or until-for-use tank systems promptly responded to, and functioning ground water reconitoring system. (d) Containment system has sufficient capacity to hold volume of all tanks within tank containment area and to provide adequate treeboard, single liner under that containment area with functioning leachate collection and removal system below liner, and functioning ground water monitoring system. (e) Sente as (d) except: double liner under tank, containment area with functioning leachate collection and removal system between liners.	5 3
accumulated precipitation removed in timely manner, at teast weekly inspection of tank and secondary containment system, all leaking or unit-for-use tank systems promptly responded to, and functioning ground water reconlining systems has sufficient capacity to hold volume of all tanks within tank containment area and to provide adequate freeboard, single liner under that containment area with functioning leachate collection and removal system below liner, and functioning ground water monitoring system. (e) Sente as (i) except: double liner under tank containment area with functioning leachate collection and removal system between liners. ank is above ground, and inside or under melesained intact structure that provides protection from precipitation	5 3 0
accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leaking or until-for-use tank systems promptly responded to, and functioning ground water reconitoring system. (d) Containment system has sufficient capacity to hold volume of all tanks within tank containment area and to provide adequate treeboard, single liner under that containment area with functioning leachate collection and removal system below liner, and functioning ground water monitoring system. (e) Sente as (d) except: double liner under tank, containment area with functioning leachate collection and removal system between liners.	5 3 0

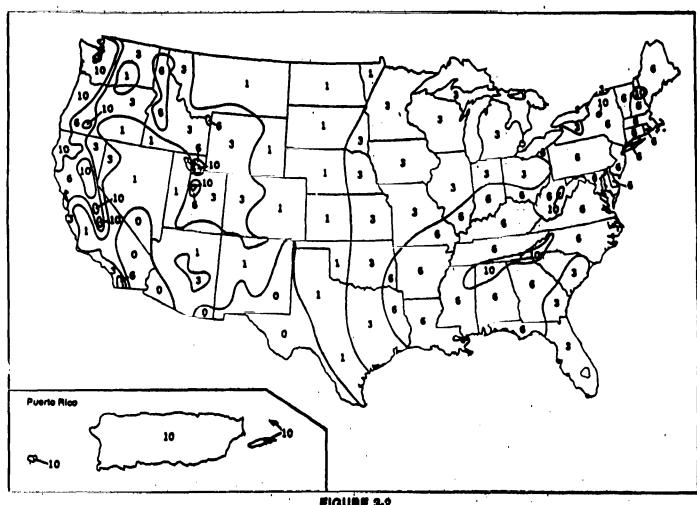


FIGURE 3-2 NET PRECIPITATION FACTOR VALUES

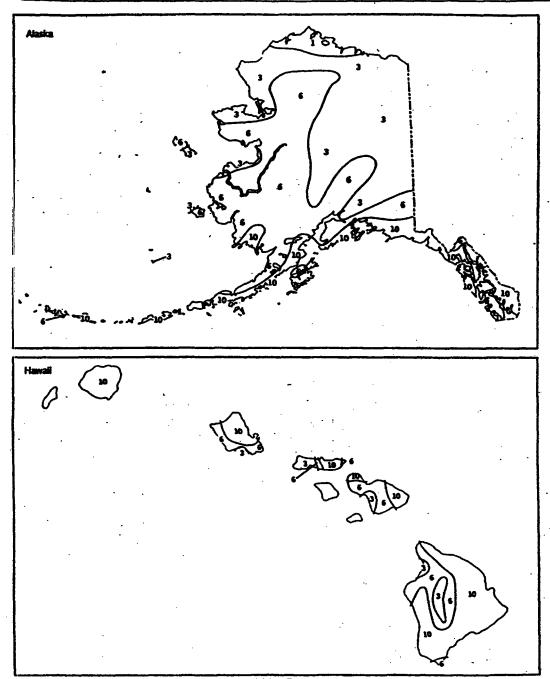


FIGURE 3-2
NET PRECIPITATION FACTOR VALUES
(CONCLUDED)

- -What measured mentaly evapolitans similar to not available. calculate monthly potential evenetrangisation (E.) as follows: E, = 04 F, (10 T,/1)
 - E,—Monthly potential evapotemphodon (inches) for month i.
 - F₁=Mouthly letteds adjusting value for month i.
 - T₁-Moon mouthly temperature (*C) for menth i.

a=475×16**[*-7.71×10**[*+ 1.79×10⁻¹[+0.40238

Select the latitude adjusting value for each month from Table 3-3. For latitudes lower than W North or 20' South, determine the eathly latitude adjusting value by

Calculate monthly set precipitation by subtracting mentally evapotranspiration (or

mentally potential evapotranspiration) from mentally precipitation. If evapotranspiration (or potential evapotranspiration) exceeds precipitation for a month, assign that month a

act procipitation value of 0.

Calculate the annual act precipitation by somming the monthly act precipitation

Bored on the annual net poscipitation, assign a net precipitation factor value from Table 3-4.

Enter the value assigned from Figure 3-2 or from Table 3-4, as appropriate, in Table 3-1.

TABLE 3-3.-- MONTHLY LATITUDE ADJUSTING VALUES

(tabana) (tapana)		Mesh										
	Jan	Feb.	March	فسيد	-	Jerre	July	August	Supt	Oct	Max.	Dec.
≥ 50 H	924	9.78	142	1.15	1.33	1.36	1.37	1.5	1.85	9.92	9.76	0.70
6 N	40	0.81	1.00	1.13	1.25	1.20	1.31	1.21	1.94	0.94	9.79	0.75
49 N	401	0.83	1.00	1.11	1.24	1.25	1.27	1.18	1.04	0.96	0.83	0.81
35 N	947	0.85	1.80	1.80	1.21	1.21	1.23	1.16	1.03	9.97	0.00	0.05
39 H	8.50	0.67	1.00	1.80	1.18	1.17	1.30	1.14	1.65	0.98	0.00	0.80
20 H	0.95	0.00	1.63	1.85	1,13	1.11	1.14	1.11	1.02	1.00	0.93	0.94
10 M	1.00	0.01	1.00	1.80	1.86	1.06	1.06	1.07	1.02	1.02	0.55	0.56
•	1.94	0.94	1.04	1.91	1.04	1.91	1.04	1.84	1.01	1.84	1.91	1.00
19 S	148	0.97	1.05	0.90	1.00	0.96	1.00	1.02	1.00	1.06	1.05	1.00
39 S	LH	6.30	1.65	0.57	0.96	0.91	0.95	0.99	1.00	1.08	1.00	1,15

* Do sell month to enemal integer. * For unlisted believing insure than 50° House or 20° Smalls, determine the believe adjusting value by integrabilles.

TABLE 3-4.—NET PRECENTATION FACTOR CONST VALUES

Hat precipitation (inches)	Assigned
Chester than 0 to 5 Chester than 5 to 15 Chester than 15 to 31 Chester than 15 to 31	0 1 3 6

2.1.23 Dapli to spafer. Brahate depth to applier by determining the depth from the lowest known point of hexacelous substances at a site to the top of the applier being evolunted, considering all layers in that interval. Measure the depth to an aquifer so the distance from the surface to the top of the applier matern the distance from the surface to the lowest known point of lagrandous substances eligible to be evolunted for that aquifer, in evolunting depth to aquifer in least teacule, assign a thickness of 0 feet to a larger aquifer that unduling any portion of the Execut terroris, assign a thickness of 9 fact to a least aquifur that undulies may portion of the sources at the site. Based on the calculated depth, assign a value from Table 3–5 to the depth to aquifur factor.

Determine the depth to provide solve at

ips to expense mone.
Determine the depth to equilier only at scations within 2 miles of the sources at the she, except if observed ground water

anicotico ettibo stable to sources at the alto extends more than 2 miles beyond these sources, use any location within the limits of source, we say recause when the most this observed ground water contamination when evaluating the depth to aquifer factor for any equiler that does not have an for any squiler that does not have an observed subsec. If the necessary geologic information is available at multiple locations, calculate the dupth to equifer at each location. Use the location having the smallest dopth to assign the factor value. Enter this value in Table 3-1.

TABLE 3-5.—DEPTH TO AQUIFER FACTOR VALUES

Dupth to against fleety	~==
Lass then or equal to 25	5 3 1

"Use depth of all layers between the hazardess substances and against. Assign a thickness of 0 last to any lazed against that underlies any portion of the sources at the site.

3.1.24 Travel time. Evaluate the travel thre factor based on the prologic materials in the interval between the lowest known point of hazardom substances at the site and the top of the aquifer being evaluated. Assign value to the travel time factor as follows:

* If the depth to aquifer (see section 3.1.2.3) is 10 feet or loss, essign a value of 35.

* If, for the interval being evaluated, all layers that unlesse a portion of the sources at the site are least, assign a value of 35.

* Otherwise:

-Select the lowest hydranlic conductivity layer(s) from within the above interval. Consider only layers at least 3 fact thick. However, do not consider layers or portions of layers within the first 10

from in-oits or laboratory tests. Use representative, measured, hydroslic conductivity values whenever evallable.

If more than one layer has the same lowest hydranlic conductivity, include all such layers and sum their thicknesses. Assign a thickness of 0 feet to a least layer that underlies any portion of the sources at the site.

-Assign a value from Table 3-7 to the travel time factor, based on the thickness and hydronic conductivity of the lowest hydronic conductivity layer(s).

TABLE 3-6.--HYDRAULIC CONDUCTIVITY OF GEOLOGIC MATERIALS

Type of material	Assigned hydraulic conductivity • (cm/sec)	
Clay; low permeability till (compact unitactured till); shale; unitactured metamorphic and igneous rocks. Sit; lossses; sity clays; sediments that are predominantly sits; moderately permeabile till (time-grained, unconsolidated till, or compact till with some fractures); low permeability finestones and dolomites (no learnt); low permeability sandstone; low permeability finestones and dolomites (no learnt); low permeability sandstone; low permeability finestones and dolomites (no learnt); low permeability sandstone; low permeability finestones and dolomites (no learnt); low permeability sandstone; low permeability finestones and dolomites (no learnt); low permeability sandstone; low permeabili	10- 10-8	
Sands; sandy sits; sediments that are predominantly sand, highly permeable #8 (coarse-grained, unconecidated or compact and highly fractured; pest, moderately permeable limestones and dolomities (no large; moderately permeable; moderately permeable fractured ignorus and metamorphic rocks.	-4	2
Gravet, clean sand, highly personable fractured igneous and moternosphic rocks; permeable basels hard limestones and dictorilies.	10-2 10	

^{*} Do not round to nearest integer.

TABLE 3-7.-TRAVEL TIME FACTOR VALUES *

	Thickness of lowest hydraulic conductivity layer(s)* (feet)				
Hydraulic conductivity (cm/sec)	Greater than 3 to 5	Greater than 5 to 100	Greater than 100 to 500	Greater then 500	
Erester then or equal to 10 ⁻³ Less than 10 ⁻³ to 10 ⁻³ Less than 10 ⁻³ to 10 ⁻⁷ Less than 10 ⁻³ to 10 ⁻⁷	35 35 15 5	35 25 15 5	35 15 5	25 15 5	

[&]quot;If depth to aquiller is 10 feet or less or if, for the interval being evaluated, all layers that underlie a portion of the sources at the site are karst, assign a value of

Determine travel time only at locations within 2 miles of the sources at the site, except if observed ground water contamination attributable to sources at the site extends more than 2 miles beyond these so arces, use any location within the limits of this observed ground water contamination when evaluating the travel time factor for any agrifer that does not have an observed release. If the necessary subsurface geologic information is available at multiple locations, evaluate the travel time factor at each location. Use the location having the highest travel time factor value to assign the factor value for the aquifer. Enter this value in Table 3-1.

3.1.2.5 Colculation of potential to release factor value. Sum the factor values for net precipitation, depth to aquifer, and travel time, and multiply this sum by the factor value for containment. Assign this product as the potential to release factor value for the aquifer. Enter this value in Table 3-1.

3.1.5 Calculation of likelihood of release factor category value. If an observed release is established for an aquifer, ssign the observed release factor value of 530 as the

likelihood of release factor category value for that aquifer. Otherwise, assign the potential to release factor value for that aquifer as the likelihood of release value. Enter the value assigned in Table 3-1.

3.2 Waste characteristics. Evaluate the waste characteristics factor category for an aquifer based on two factors: toxicity/mobility and hazardous waste quantity. Evaluate only those hazardous substances aveilable to migrate from the sources at the site to ground water. Such hazardous substances include:

 Hazardous substances that meet the criteria for an observed release to ground water.

 All hazardous substances associated with a source that has a ground water containment factor value greater than 0 (see sections 2.2.2, 2.2.3, and 3.1.2.1).

3.2.1 Toxicity/mobility. For each hazardous substance, assign a toxicity factor value, a mobility factor value, and a combined toxicity/mobility factor value as specified in the following sections. Select the toxicity/mobility factor value for the aquifer being evaluated as specified in section 3.2.1.3.

3.2.1.1 Toxicity. Assign a toxicity factor value to each hazardous substance as specified in Section 2.4.1.1.

3.2.1.2 Mobility. Assign a mobility factor value to each hazardous substance for the aquifer being evaluated as follows:

 For any hazardous substance that meets the criteria for an observed release by chemical analysis to one or more aquifers underlying the sources at the site, regardless of the aquifer being evaluated, assign a mobility factor value of 1.

• For any hazardous substance that does not meet the criteria for an observed release by chemical analysis to at least one of the aquifers, assign that hazardous substance a mobility factor value from Table 3-8 for the aquifer being evaluated, based on its water solubility and distribution coefficient (K₄).

 If the hazardous substance cannot be assigned a mobility factor value because data on its water solubility or distribution coefficient are not available, use other hazardous substances for which information is available in evaluating the pathway.

TABLE 3-8.—GROUND WATER MOBILITY FACTOR VALUES *

	Distribution coefficient (KJ) (mt/g)				
Water solubility (mg/l)	Karst *	≤10	>10 to 1,000	>1,000	
Hresent as liquid b Greater than 1 to 100 Greater than 0.01 to 1 Less than or equal to 0.01	1 0.2 0.002 2x10 ⁻³	1 0.2 0.002 2x10-5	0.01 0.01 0.002 2x10 ⁻³ 2x10 ⁻⁷	9,0001 6,0001 2x10 ⁻³ 2x10 ⁻³ 2x10 ⁻³	

^{*} Do not round to nearest integer

^{*}Consider only layers at least 3 feet thick. Do not consider layers or portions of layers within the first 10 feet of the depth to the aquiller.

Je if the hazardous substance is present or deposited as a liquid.

[&]quot;Use if the entire interval from the source to the aquifer being evaluated is karst

no of the layer بلدو وسماك eligible to be evaluated can be assigned a mobility factor value, use a default value of 0.000 on the mobility factor value for all those

Determine the water solubility to be used in Table 2-4 for the heaverloss substance as follows (one this same water solubility for all

- Per exp houseless substance that does not most the calcula for an observed release by chemical analysis. If the hexardons by chemical analysis, it was necessarial as a figurid, substance is present or deposited as a figurid, use the water subshiftly category "Present as Liquid" in Table 3-8 to assign the mobility factor value to that hazardous substance.

 - -Per any houselous substance that is a most of constalled and that does not most the collects for an observed release by chanical energies, establish a water solubility for the hazardous substance as follows:
 - Determine the overall range of water solubilities for compounds of this homelyne substance (counter all ade for which adopted e solubility information is ereliable, not just compounds identified as present at the site).

Calculate the governatric meet of highest and the lowest water couldity in this range. ematric mass of the

- -- Use this geometric mean as the water solubility in assigning the houndour substance a mobility factor value from Table 2-4.
- -Per my other hazardous substance (other expense or inorganic) that dear not most the criterie for an observed

release by chemical analysis, use the water solubility of that hazarde stance to assign a mobility facts value from Table 3-8 to the hazardous substance.

For the aquifer being evaluated, determ or distribution coefficient to be used in Table 3-8 for the hazardous substance as

- For any hexardous substance that does not meet the criteria for an observed release by chemical analysis, if the entire interval from a source at the site to the aquifer being evaluated in knost, use the distribution coefficient category "Karet" in Table 3-8 in easigning the mobility factor value for that ezardous substance for thet equific.

 Otherwise:
 - - -For any hexardous substance that is a metal (or metalloid) and that does not most the criteria for an observed one by chemical analysis, use the ution coefficient for the metal or netalloid) to assign a mobility factor ine from Table 3-6 for that hazardous substance.
 - For any other inorganic hezardous more that does not meet the criteria for an observed release by chemical analysis, use the distribution coefficient for that it or unic hazardous substance, if available, to assign a mobility factor value from Table 3-8. If the distribution coefficie is not available, use a default value of less than 10" as the distribution coefficient, except: for asbestes use a default value of "greater than 1,000" as the distribution coefficient.

- -For any hazardous substance that is erganic and that does not meet criteria for an observed release chemical analysis, establish a distribution coefficient for that ic and that does not meet the ese by
- hezerdons enhance as follows: -Estimate the K₄ range for the hazardous substance following equation: nce using the
 - K-(K-)(L) the same
 - K_{er}=Soll-water partition coefficient for organic carbon for the hexardous substance.
 - E-Serbeat content (fraction of clays plus organic carbon) in the subserface.
- -Use f, values of 0.03 and 0.77 in the above equation to establish the upper and lower values of the K. e for the hexardous substance.
- Calculate the geometric mean of the upper and house; K_d range values. se this geometric mean as the stribution coefficient in essign نساسته the hazardous substance a mobility factor value from Table 3-8.

3.2.1.3 Culculation of toxicity/mobility factor value. Assign each hexardons substance a texticity/mobility factor value from Table 3-0, based on the values assigned to the hexardous substance for the texticity and mobility factors. Use the hexardous substance and the hexardous substance are substance as the hexardous substance and the hexardous substance are substance as the hexardous substance for the hexardous subs substance with the highest toxicity/mobility factor value for the equific being evaluated to easign the value to the toxicity/mobility factor for that equific. Enter this value in Table 3-1.

TABLE 3-0.—TODICITY/MOBILITY FACTOR VALUES *

-	Training factor value								
	16,000	1,000	100	10	1	•			
1.9	10.000	1,000	180	10	1				
8.2	2,000	290	20	2	0.2	(o			
	100	10	1	0.1	0.01) 0			
0.002	20	2	0.2	9.92	0.000				
4.000	1	0.1	0.01	0.001	1x10-4	0			
2:00-4	. 62	0.02	0.002		200-3				
2:10° 2:10°	0.002	2:10-4	2x10"	2:18	2118-7				
2419**	2:10-1	2:10-4	2x10-7	2:10 ⁻⁴ 2:10 ⁻⁴ 2:10 ⁻⁶	\$210°° 2110°° 2110°° 2110°°	0			

^{*}Do not spend to assess infance.

- 3.2.2 Heatedous weste quantity. Assi standous veste quantity factor value for the ound water politory (or equifer) as section 2.4.2. Enter this value in Table 3-1.
- 3.2.3 Calculation of muste characteristics factor category value. Multiply the tracity/ seardone waste questity factor to a mercinam product of alaby or 1 values, subject to a maximum product of 1×10°. Based on this product, easign a value from Table 2-7 (section 2.4.3.1) to the waste eracteristics factor category. Eater this value in Table 3-L
- 3.3 Targets. Evaluate the targets factor category for an equifer based on four factors.
- nearest well, population, resources, and Wellhood Posts. Jiou Area. Evaluate these four factors based on targets within the target stance limit specified in section 1.0.1.1 and the aquiler boundaries specified in section 3.0.1.2. Determine the targets to be included in evaluating these factors for an equifer as specified in section 1.0.
- 3.3.1 Nearest well. In evaluating the nearest well factor, include both the drinking water wells drawing from the aquifer being evaluated and those drawing from overlying aquifers as specified in section 3.0. Include standby wells in evaluating this factor only if

they are used for drinking water supply at least once every year.

If there is an observed release by direct beervation for a drinking water well within the target distance limit, assign Level II concentrations to that well. However, if one or more samples meet the criteria for an observed release for that well, determine if that well is subject to Level I or Level II concentrations as specified in sections 25.1 and 25.2. Use the bealth-based benchmarks from Table 3-10 in determining the level of

Assign a value for the nearest well factor as follows:

- If one or more drinking water wells is subject to Level I concentrations, assign a value of 50.
- If not, but if one or more drinking water wells is subject to Level II concentrations, assign a value of 45.
 If none of the drinking water wells is

subject to Level I or Level II concentrations,

- If one of the target equifiers is a karst equifer that underlies any portion of aquiter that underties any portion of the sources at the site and any well draws drinking water from this kerst aquifer within the target distance limit, assign a value of 20.

 If not, determine the abortest distance
- to say drinking water well, as stired from any source at the site with a ground-water containment factor value greater then 0. Select a factor value greater them 0. Select a value from Table 3-11 based on this distance. Assign it as the value for the nearest well factor.

Enter the value assigned to the nearest well factor in Table 3-1.

TABLE 3-10.--HEALTH-BASED BENCH-MARKS FOR HAZARDOUS SUBSTANCES IN DRINKING WATER

- Concentration corresponding to Maximum Contentinent Level (MCL):
- corresponding to a nominant Level Goal (MCLG).
 Identification for carrier con Concentration com
 Conteminent
- ning concen to that concentration that corresponds to the 10° individual cancer risk for oral separature.

 Screening concentration for noncenter textcologi-
- ness corresponding to the Reference Dose (RID) for and exposure

TABLE 3-11.—NEAREST WELL FACTOR VALUES

Distance from source (railes)	Assigned value
Level I concentrations*	50 45
Greater than ¼ to ½	20 18
Greater than 1 to 2 Greater than 2 to 3 Greater than 3 to 4	5 3
Greater than 4	•

^{*} Distance does not apply.

3.3.2 Population. In evaluating the population factor, include those persons served by drinking water wells within the stance limit specified in section 3.8.1.1. For the equifer being evaluated, count those persons served by wells in that aquifer ose persons served by wells in overlying aquifers as specified in section 3.0. Include residents, students, and workers who

regularly use the water. Exclude transient populations such as customers and travelers possing through the area. Evaluate the population based on the location of the water supply wells, not on the location of residences. tesidences, work places, etc. When a standby well is maintained on a regular basis so that water can be withdrawn, include it in

water can be withdrawn, include it in evaluating the population factor.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located. In determining the population served by a well, if the water from the well is blended with other water flor example, water from other stought water from other stought water are not persons wither

with outer week the version water with other ground water wells or surface wither intakes), apportion the total population regularly served by the blended system to the well based on the well's relative contribution. went based on the west resulting the to the total blended system. In astimating the well's relative contributes, assume each well and intake contributes equally and apportion the population accordingly; except: if the relative contribution of any one well or intake exceeds 40 percent based on everage annual pumpage or capacity, estimate the relative contribution of the wells and intakes considering the following data, if available:

 Average annual pumpage from the ground water wells and surface water intakes in the blended system.
• Capacities of the wells and intakes in the

blended system.

For systems with standby ground water wells or standby surface water intakes, apportion the total population regularly served by the blended system as described above, except:

• Exclude standby surface water intakes in apportioning the population.

 When using pumpage data for a standby ground water well, use average pumpage for the period during which the standby well is ed rather than everage annual pumpage.

• For that portion of the total population

that could be apportioned to a standby ground water well, assign that portion of the population either to that standby well or to the other ground water well(s) and surface water intake(s) that serve that population; do not assign that portion of the population both to the standby well and to the other well(s) and intake(s) in the blended system. Use the ann ansares in one cannot system. Use the apportation factor value. (Either include all standby-well(e) or exclude some or all of the standby well(s) as appropriate to obtain this highest value.) Note that the specific standby well(s) included or excluded and, thus, the specific apportioning may vary in evaluating different aquifers and in evaluating the surface water pathway.

3.3:2.1 Level of contamination. Evaluate the population served by water from a point of withdrawal based on the level of

contamination for that point of withdrawel. Use the applicable factor: Level I concentrations. Level II concentrations, or notential contemination

if no samples meet the criteria for an observed release for a point of withdrawal and there is no observed release by direct observation for that point of withdrawal. evaluate that point of withdrawal using the potential conta minetion factor in section 3.3.2.4. If there is an observed release by. direct observation, use Level H concentrations for that point of withdrawal. However, if one or more samples most the criteria for an observed release for the point of withdrawal, determine which factor (Level on windrawa, assumer want a mass parties to that point of withdrawal as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 3-10 in determining the level of contamination. Evaluate the point of withdrawal using the Level I concentrations factor in section 3.3.2.2 or the Level II concentrations factor in section 3.3.2.3, as appropriate.

For the potential contamination factor, use

population ranges in evaluating the factor as specified in section 3.3.2.4. For the Level I and Level II concentrations factors, use the population estimate, not population ranges, in lusting both factors.

3.3.2.2 Level I concentrations. Sum the number of people served by drinking water from points of withdrawel subject to Level I concentrations. Multiply this sum by 10.
Assign this product as the value for this factor. Enter this value in Table 3-1.

3.3.2.3 Level II concentrations. Sum the number of people served by drinking water from points of withdrawal subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table

3.3.2.4 Potential contamination. Determine the number of people served by drinking water from points of withdrawal subject to potential contamination. Do not include those people already counted under the Level I and Level II concentrations

Assign distance-weighted population values from Table 3-42 to this population as

• Use the "Kazst" portion of Table 3-12 to assign values only for that portion of the population served by points of withdrawal that draw drinking water from a kenst aquifer that underlies any portion of the sources at the site.

-For this portion of the population. determine the number of people included within each "Karst" distance category in Table 3-12.

TABLE 3-12.—DISTANCE-WEIGHTED POPULATION VALUES FOR POPUNTAL CONTAININTION FACTOR FOR GROUND WATER MIGRATION PA HWAY

	Number of people within the distance category												
Datance category (miles)	•	. 22	1 0 3	31 to 100	101 0 300	391 to 1,008	1,901 to 2,000	3,801 to 19,000	19,501 38,680	30,001 to 100,000	100,001	369,601 to 1,600,608	1,900,001 3,000,000
Gener Then Reset*: 8 to N		1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	17 11 5 3 2	28 17 18 7 4	#	22 A B W	1,858 1,950 930 272 131	5.214 3.208 1,600 500 678 417	16,325 10,122 6,384 2,507 2,122 1,306	\$2,537 \$2,935 16,601 0,395 0,770 4,571	163,346 161,233 52,336 26,336 21,322 13,666	521,269 522,943 100,665 52,945 67,777 41,709	1,832,455 1,812,122 522,365 283,842 212,219 130,586
Kost*: 0 to %: Guster than % to %: Guster than % to 1. Guster than 1 to 2. Guster than 2 to 3. Guster than 3 to 4.		4 2 2 2 2 2 2	17 11 9	2	ない。	和2 204 204 201 201 201	1,688 1,919 817 817 817 817	5,214 3,213 2,807 2,807 2,807 2,807	16,325 16,122 6,168 6,163 6,163 6,163	99_137 35_225 25_688 28_688 28_688 28_688	101,316 101,213 81,638 81,623 81,623	\$21,300 \$23,243 \$83,600 263,600 263,600	1,832,455 1,912,122 816,227 816,227 816,227 816,227

[&]quot;Record the number of people present within a distance category to respect belongs. Do not round the assigned deterco-weighed population value to nearest

*Use for all equitors, except inent replies underlying any parties of the sources at the site. *Use gody for fight against underlying any parties of the steatons at the site.

n a distance evelabled pape s for each distance enteger on the number of people included within the distance category.

10 the "Other Heat "

- Use the "Other Then Keest" portion of ship 3-12 for the sensainder of the polation served by points of withdrawal. Spect to potential contemberation. Table 3-12 for the pa
 - -Per this portion of the population, determine the number of people included within each "Other Thenincluded victim each "Own" James Mariff distance category in Table 3-12.
 Assign a distance-resigned population
 value for each distance category based
 on the manhet of people included
 within the distance category.

Calculate the value for the potential estamination factor (PC) as follows:

$$PC = \frac{1}{2} \quad \begin{array}{ccc} 0 & \{W_i + K_j\} \\ \hline 10 & i=1 \end{array}$$

Distance weighted population from "Other Than Karet" portion of Table 3-12

for distance category i. Distance-weighted population fro "Knool" postion of Table 3-12 for distance category i. ion bon

distance entrancy i. a=Number of distance entrancies.

If PC is less than 1. do not round it to the et integer, if PC is 1 or more, round to report integer. Enter this value in Table

- 33.25 Calculation of population factor rules. Sum the factor values for Level 1 concentrations. Level E concentrations, and potential contamination. Do not round this um to the nearest integer. Assign this own as he population factor value for the equifer the population factor value for Enter this value in Table 3-1.
- 3.3.3 Resources. To evaluate the resources factor, select the highest value specified below that applies for the aquiler being evaluated. Assign this value as the

resources factor value for the squifer. Enter this value in Table 3-1.

Assign a resources value of 5 if water rown from any target well for the equiler g ovaluated or overlying aquifers (as specified in section 3.05 is used for one or

- state of the following purposes:

 Intigration (5-acre minimum) of commercial food croys or commercial forage CTOBS.
- Watering of commercial livestock.
 Ingentient in commercial food
- preparation.
- Supply for commercial aquaculture.
 Supply for a major or designated water screenism gree, excluding drinking water see. recreed

Atolian a massurces value of 5 If no drinking the wells are within the target distance of. but the water in the inpalier being abusted in any overlying aquifies (as acilled in section 3.0) to usable for drinking water purposes.

ign a staurarces value of 0 if some of the

above applies.

1.3.4 Wallhood Protection Area. Brainste the Wallhard Protection Area factor based on Wellhard Protection Areas designated accurating to suction 1428 of the Safe Deluting Water Act, so emended. Consider only thes reliand Protection Arons applicable to the quite being evaluated or overlying aquiles so specified in section 3.0). Select the highest value below that applies. Assign it as the value for the Wellheyd Protection Area factor for the equifer being evaluated. Enter this value in Table 3-1.

Assign a value of 20 if either of the following criteria applies for the aquifer being evaluated or overlying equifers:

- · A source with a ground water containment factor value greater than 0 lies. either partially or fully, within or above the designated Wellhead Protection Area.
- Observed ground water contamination attributable to the sources at the site lies. either partially or fully, within the designated. Wellhead Protection Area.

If neither criterion applies, assign a value of S. II, which the target distance limit, there is a designated Wellhood Protection Area applicable to the aquifer being evaluated or

Analys a value of 0 if some of the above opplies.

3.3.5 Colculation of targets factor cotagory value. Sum the factor values for company vestil, population, resources, and Wellhard Protection Area. Do not round this sum to the nearest integer. Use this sum as the targets factor entegory value for the aquiler. Enter this value in Table 3-1.

- 3.4 Ground water migration score for an applier. For the applier being evaluated, multiply the factor conguey values for likelihood of release, wante characteristics. ets, and round the product to the and her neasest integer. Then divide by \$2,300, Assign the estuding value, subject to a national value of 100, as the ground water migrati-pulsary scare for the aquifer. Buttr this score in Table 3-1.
- active in 1968 3-1.

 35 Colculation of ground water migration pathway score. Colculate a ground water migration score for each aquifer underlying the sources at the site, as appropriate. Assign the highest ground water migration accre for an aquifer as the ground water migration. on agains so the ground water migration pathway score (S_m) for the site. Enter this score in Table 3-1.
- 4.0 Surface Water Migration Pathway.
- 4.0.1 Alignation components: Evaluate the surface water migration pathway based on two migration components:

 Overland/flood migration to surface
- water (see section 4.1).
- · Ground water to surface water migration (see section 4.2).

Evaluate each component based on the same three threats: drinking water threat, homan food chain threat, and environmental threat.

Score one or both components, considering ibeir relative importance. If only one component is scored, assign its score as the surface water migration pathway score. If

both components are scored, select the higher of the two scores and assign it as the surface water migration pathway score.

4.0.2 Surface water categories. For HRS purposes, classify surface water into four categories: rivers, lakes, oceans, and coastal tidal waters.

Rivers include:

- Perennially flowing waters from point of origin to the ocean or to constal tidal waters, whichever comes first, and wetlands contiguous to these flowing waters.
 Aboveground portions of disappearing
- river
- Man-made ditches only insofar as they perennially flow into other surface water.
- Intermittently flowing waters and contiguous intermittently flowing ditches only in arid or sentiarid areas with less than 20 inches of mean annual precipitation.

Lakes include:

- Natural and man-made lakes (including impoundments) that lie along rivers, but excluding the Great Lakes.
- · isolated, but perennial, lakes, ponds, and
- . Static water channels or oxbow lakes contiguous to rivers.
- · Small rivers, without diking, that merge into surrounding perennially inundated
- Wetlands contiguous to water bodies defined here as lakes.

 Ocean and ocean-like water bodies

include:

- · Ocean areas seaward from the baseline of the Territorial Sea. (This baseline represents the generalized constline of the United States. It is parallel to the seaward limit of the Territorial Sea and other maritime limits such as the inner boundary of Federal fisheries jurisdiction and the limit of States jurisdiction under the Submerged Lands Act, as amended.)
 - The Great Lakes.
- Wetlands contiguous to the Great Lakes.
 Coastal tidal waters include:
- Embayments, harbors, sounds, estuaries, back bays, lagoons, wetlands, etc. seaward from mouths of rivers and landward from the baseline of the Territorial Sea.
- 4.1 Overland/flood migration component. Use the overland/filood migration component to evaluate surface water threats that result from overland migration of hazardous substances from a source at the site to surface water. Evaluate three types of threats for this component: drinking water threat, human food chain threat, and environmental
 - 4.1.1 General considerations.
- 4.1.1.1 Definition of hazardous substance migration path for overland/flood migration component. The hazardous substance migration path includes both the overland segment and the in-water segment that hazardous substances would take as they migrate away from sources at the site:
- Begin the overland segment at a source and proceed downgradient to the probable point of entry to surface water.
- · Begin the in-water segment at this probable point of entry.
 - -For rivers, continue the in-water segment in the direction of flow (including any tidal flows) for the

distance established by the target distance limit (se a section 4.1.1.2).

For lakes, oceans, coastal tidal waters, or Great Lakes, do not consider flow direction. Instead apply the target distance limit as an arc

if the in-water segment includes both rivers and lakes (or oceans, coestal tidal waters, or Great Lakes), apply the target distance limit to their combined in-water segments.

For sites that consist of contaminated ediments with no identified source, the hazardous substance migration path consists olely of the in-water segment specified in section 4.1.1.2.

Consider a site to be in two or more watersheds for this component if two or more hazardous substance migration paths from the sources at the site do not reach a con point within the target distance limit. If the site is in more than one watershed, define a separate hazardous substance migration path for each watershed. Evaluate the overland/ flood migration component for each watershed separately as specified in section 4.1.1.3

4.1.1.2 Target distance limit. The target distance limit defines the maximum distance over which targets are considered in evaluating the site. Determine a separate target distance limit for each watershed as

• If there is no observed release to surface water in the watershed or if there is an observed release only by direct observation (see section 4.1.2.1.1), begin measuring the target distance limit for the watershed at the probable point of entry to surface water and extend it for 15 miles along the surface water from that point.

 If there is an observed release from the site to the surface water in the watersh that is based on sampling, begin measuring the target distance limit for the watershed at the probable point of entry; extend the target ance limit either for 15 miles along the surface water or to the most distant sample point that meets the criteria for an observed release to that watershed, whichever is greater.

In evaluating the site, include only surface water targets (for example, intakes, fisheries, sensitive environments) that are within or contiguous to the hazardous substance migration path and located, partially or wholly, at or between the probable point of entry and the target distance limit applicable to the watershed:

· If flow within the hazardous substance migration path is reversed by tides, evaluate upstream targets only if there is documentation that the tidal run could carry substances from the site as far as those upstream targets.

· Determine whether targets within or contiguous to the hazardous substance migration path are subject to actual or potential contamination as follows

> -If a target is located, partially or wholly, either at or between the probable point of entry and any sampling point that meets the criteria for an observed release to the watershed or at a point that meets the criteria for an observed release by direct observation, evaluate

that target as subject to actual contamination, except as otherwise specified for fisheries in section 4.1.3.3 and for wetlands in section 4.1.4.3.1.1. If the actual contamination is based on direct observation, assign Level II to the actual contamination Florence if the actual contamination is based on samples, determine whether the actual contamination is at Level I or Level II concentrations as specified in sections 41.23, 41.33, and 4.1.4.3.1.

If a target is located, pertially or wholly, within the target distance limit for the eshed, but not at or between the probable point of entry and my sampling point that mosts the criteria for an observed release to the watershed, nor at a point that meets the criteria for an observed release by direct observation, evaluate it as subject to potential contamination.

For sites consisting solely of contaminated sediments with no identified source,

determine the target distance limit as follows:

• If there is a clearly defined direction of flow for the surface water body (or bodies) containing the contaminated sedi measuring the target distance limit at the point of observed sediment contamination that is farthest upstream (that is, at the location of the farthest available upstream sediment sample that meets the criteria for an observed release); extend the target distance limit either for 15 miles along the surface water or to the most distant downstream sample point that meets the criteria for an observed release to that

watershed, whichever is greater.

• If there is no clearly defined direction of flow, begin measuring the target distance limit at the center of the area of observed sediment contamination. Extend the target distance limit as an arc either for 15 mile along the surface water or to the most distant sample point that meets the criteria for an observed release to that watershed. whichever is greater. Determine the area of observed sediment contamination based on available samples that meet the criteris for an observed release.

Note that the hazardous substance migration path for these contaminated sediment sites consists solely of the in-water segment defined by the target distance limit; there is no overland segment.

For these contaminated sediment sites. include only those targets (for example, intakes, fisheries, sensitive environments) that are within or contiguous to the hazardous substance migration path and located, wholly or partially, within the target distance limit for the site. Determine whether these targets are subject to actual or potential contamination as follows:

- If a target is located, partially or wholly, within the area of observed sediment contamination, evaluate it as subject to actual contamination, except as otherwise specified for fisheries in section 4.1.3.3 and wetlands in section 4.1.4.3.1.1.
 - -If a drinking water target is subject to actual contamination, evaluate it using Level II concentrations.

If a human final chain teget or confinemental teget in subject to actual contemberation, orbitals. It wis Lovel I or Lovel II concentrations, or appropriate free society 41.33 and MAND

 If a taget is boated, partially or whithin the larget distance limit for the element. But not retained in each of manned and transition, areas. act to pate

component based on three factor against Madhapel of relegae, wants stagesion: Mottheod of colones, waste beneated files, and targets. Figure 4-1 adjustes the factors included within each actor category for each type of thesel. Datemains the overland/fleed stigration component acout (\$\(\) for a vectorised in man of the factor category values to \$\(\). factor call

LR,—Likelihand of schoos factor cittager, value for threat (glast is, delaking we human food chain, or controvamental

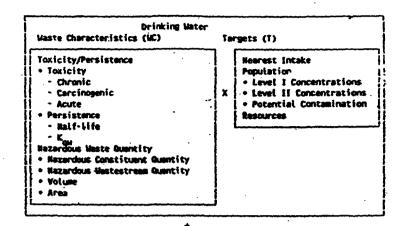
Weste characteristics Sector category for Ser Seriet L

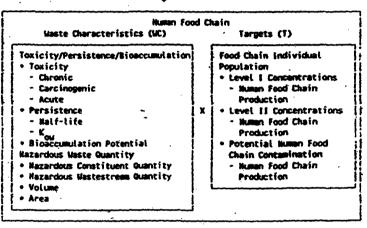
vener my terest t.
T_em Daysto factor catagory value for the SF-effecting factor.
Table 4-2 culture the specific calculation

If the other is to early one vestershed, assign to constant/filest extraction score for that retended on the overland/flood migration

Likelihood of Release (LR) Observed Release - or Potential to Release by Overland Flow Containment turioff - Rainfatt - Drainage Area - Soil Group Distance to Surface Water Potential to Release by flood . Containment (Flood) Flood frequency

¥





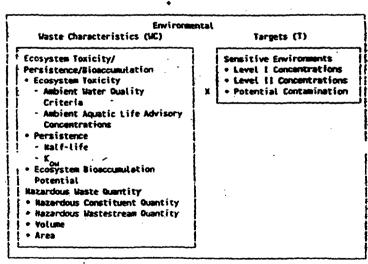


TABLE 4-1,-SURFACE WATER OVERLA D/FLOOD MIGRATION COMPONENT SCOREMEET

Pacter categories and factors	Mandagers Value	Value assigned
Scholley Weier Threat		1
Litelitand of Release 1. Charmed Release	559	l .
2. Februaries by Chartered Flows	_	
2s. Constraint	 ₩	
2 Marie Delay Marie	-⊢ ≊	
2s. Chipset to Budges the Constant Flor Gass 2s(2h+2:3)		
2 Patroid to Balance to Paint	-	1 —
St. Continuent (Florid)	*	 —
St. Flood Frequency		
Z. (1000) (100		—
4. Potential to Platease (fines 2d+3c, publicat to a movimum of 500)	500	l —
S. Lindard of Release State of last 1 and 0	550	
Committee SCOM	-	
7. Handon Wate Custon, Tillie & G		
8. Wash Changeston. T. A.M. 2-1	100	
Name of the Control o	-	
3. Reside	>>	
10. Level / Consentration		İ
All County Comments and the Comments and		
TARE H-19		1
The Properties State 1804 1804 1804 1804 1804 1804 1804 1804	 •	
The Proposition from the part and the Guidance Manual, 12 Throat Contract of the Contract of t	<u>\$</u>	
Making Water Throat Store:	-	
12. Odding Water Thread Boson (Sines Sx8x 125/92.598, exhibited to a resonant of 100)	100	-
Human Food Chain Threat		1
bulbani di fishasi:		1
14. Uniform of Reference (speech value as five \$)	{ \$50	
Neste Chimestellullus 15. Turkity-Paulations/Biographidian		
16. Handles Wate Cookly		
17. Wash Characteristics	1,000	l —
Targetic 16. Feed Chain Ind-Mad		1
ti. Penden		
tts. Land I Concentrations		<u> </u>
10s. Lord 8 Concentrations		
10c Puterful Human Food Chain Contemination	— 2	
198. Figure 1985 1987 1997 199	P	
26. Targets (fins 10+100)		
homan Food Chelo Threat Score	:	ì
21. Human Fixed Chain Threat Stone (Chain 14×17×20)/82,500, majorit to a minimum of 100)	100	
Embermental Threat	1	
Andhood of Release . 22. Likelined of Release (name value as line 5)	550	
Heale Company lates		
21. Ecosystem Terricity/Persistence/Sescoursdation	😝	
34. Hastidos Waste Cyariby		
25. Wate Characteristics	1,600	1
Communication Co		1
28 Santhe Enirament		1
Sh. Levil 1 Concentrations		-
Sits Printed Contrales		
284. Spelled Environments (from 28s+28s+28ct)		1 —
27. Targets, jester from the 204		1
integrated Threat Supra:		1
28. Environmental Persont Score (Eleus 22×25×271/102,500, subject to a maximum of 60)	~	l —
Surface Water Overland/Flood Migration Component Score for a Watershed		1
29. Westershed Score * (fines 13+21+28, subject to a maximum of 100)	100	
Surface Water Overland/Flood Illgration Component Score]
30. Composed Score (S.) ' (highest score from line 20 for all matersheds evaluated, subject to a maximum of 1001	100	1

- If the site is in more than one water
- Calculate a separate overland/Llood ignation component source for each migratio ration component score for each exched, using likelihood of releas characteristics, and targets applicable to
- · Select the highest overland/flood migration component score from the watersheds evaluated and seeign it as the overland/flood migration component score for the site.
- 4.1.2 Drinking water threat. Evaluate the drinking water threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and tergets.
 4.2.2.1 Drinking water threat—likelihood of release. Evaluate the likelihood of release factor category for each watershed in terms of an observed release factor or a potential torelease factor.
- 4.1.2.1.1 Observed release. Establish an observed release to surface water for a watershed by demonstrating that the site has released a hazardous substance to the surface water in the watershed. Base this demonstration on either:
 - Direct observation:
 - -A meterial that contains one or more hazardous substances has been seen entering surface water through migration or is known to have entered surface water through direct deposition, or
 - -A source area has been Booded at a time that hazardous substances were ent; and one or more becardous substances were in contact with the flood waters, or
 - -When evidence supports the inference of a release of a material that contr one or more hazzidous substances by the site to surface water, demonstrated adverse effects associated with that ease may also be used to establish an observed release.
 - Chemical analysis:
 - Analysis of surface water, benthic, or sediment samples indicates that the concentration of hazardous substance(s) has increased significantly above the background

- concentration or use of sample (see section 2.3).
- spies and background concentrations-for example ere surface water samples to surface water background
- Por benthic samples, limit comparisons to essentially sessile
- Some portion of the significant increase most be attributable to the sile to establish the observed release, except: m the site itself consists of ted endiments with no identified source, no separate attribution is requ

If an observed release can be est for a watershed, assign an observed release factor value of 500 to that watershed, a this value in Table 4-1, and proceed to section 41212 If no observe ed release can be riablished for the watershed, assign an observed release factor value of 0 to that watershed, easer this value in Table 4-1, and proceed to section 4.1.2.1.2.

4.1.2.1.2 Potential to release. Evaluate potential to release only if an observed release cannot be established for the watershed. Evaluate potential to relea ents: potential to based on two components: potential trelease by overland flow (see section 4.1.2.1.2.1) and potential to release by flood (see section 4.1.2.1.2.2). Sum the values for these two components to obtain the poter to release factor value for the watershed. ject to a march sam value of 500.

4.1.2.1.2.1 Potential to release by overland flow. Evaluate potential to release by overland flow for the watershed based on ree factors: containment, renoff, and distance to surface water.

Assign potential to release by overland flow a value of 0 for the watershed if:

- No overland segment of the hazardous substance migration path can be defined for the watershed, or
- The overland-segment of the hazardous substance migration path for the watershed exceeds 2 miles before surface water is encountered.

- H ebb er condition applies, enter a value of 6 in Table 4-1 and proceed to section 4.1.2.1.22 to evaluate potential to release by flood. If neither applies, proceed to section 4.1.2.1.2.1.1 to evaluate potential to release by overland
- 41.21.21.1 Containment. Determine the containment factor value for the watershed as follows:
- If one or more sources is located in surface water in the waterphed (for examp intact seeled drums in surface water), assign the containment factor a value of 10 for the watershed. Enter this value in Table 4-1.
- · If some of the sources is located in surface water in the watershed, assign a containment factor value from Table 4-2 to each source at the site that can potentially release hazardous substances to the hazardous substance migration path for this wateraned. Assign the containment factor water the translation of the property of value for the watershed as follows:
 - -Select the highest containment factor value assigned to those sources that meet the minimum size requirement described below. Assign this highest value as the contains ent factor value for the watershed. Enter this value in Table 4-1.
 - -If for this watershed, no source at the site meets the minim m size requirement, then select the highest containment factor value assi the sources at the site eligible to be evaluated for this watershed and assign it as the confainment factor value for the watershed. Enter this value in Table 4-1.

A source meets the minimum size requirement if its source hazardous waste quantity value (see section 2.4.2.1.5) is 0.5 or more. Do not include the minimum size sent in evaluating any other factor of this surface water migration component. except potential to release by flood as specified in section 4.1.2.1.2.2.3.

4.1.2.1.2.1.2 Runoff. Evaluate ranoff based on three components: rainfall, drainage area, and soil group.

Table 4-2.—Containment Factor Values for Surface Water Migration Pathway

Source	Assigned value
All Sources (Except Seriace Impostruments, Land Treatment, Containers, and Tanks)	
Evidence of hazardous substance migration from source area (i.e., source area includes source and any associated containment structures):	10
No evidence of hazardous sebetance migration from source and:	
(a) Neither of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system.	10
(b) Any one of the two items in (a) present	9
(c) Any two of the following present: (1) maintained engineered cover, or (2) functioning and craintained run-on control system and run-off management system, or (5) finer with functioning feachate collection and removal system immediately above liner.	7
(d) All items in (c) present	5
(a) All items in (c) present, plus no bulk or non-containerized liquids nor materials containing free liquids deposited in source area	3
No evidence of hazardous substance migration from source area, double liner with functioning leachate collection and removal system above and between lines, and:	
(f) Only one of the tollowing deficiencies present in containment: (1) bulk or noncontainerized liquids or materials containing free liquids	
deposited in source area, or (2)-to or nonfunctioning or nonmaintained tun-on control system and tunoff management system, or (3)- no or nonmaintained engineered cover.	_
(g) None of the deficiencies in (f) present.	0
Source area inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate is generated, liquids or materials containing free liquids not deposited in source area, and functioning and maintained run-on control present.	

Fident Register / Vol. 5: No. 241, / Priday, December 14, 1986 / Rules w

TABLE 4-2.—CONTABBIENT FACTOR VALUES FOR SURFACE WATER MIGRATION PATHMENT—Concluded

	Assigned value
Surface (Impoundment	1
	J 16
Prop Boulds propose with other on othing, unexpend othing, or othing that is not regularly inspected and maintained	<u>.</u> 10
and described the second contraction of the contrac	1
and imbalied, adequate freeheard, with	
] ;
the thereta to the backets extrates and remove extra tors	
O Paulis her with functioning inactions collection and removed system between Press	
tin delikens af hamelung aukelinog eslanden ham auteen imperioheert und all fron Squits ellebestet det alseen faller by removel a - Squits ar aukellanden al samelung westen and weste resident.	Section division
The state of the s	full to balk or to
	faith deposited.
Land Treatment	
Efficies of legandous substance migration from fund treatment sono	- 10
	' 10
No collecte of homotoxic existings expedien from land resolvent stops and: (a) Functioning and existence can on our resolvent represent system	
(i) Perchang and makehood nan-on control and nanof management system, and vegetative cover established over order bank	
testing and	
(c) Land Sugment and maintained in compliance with 40 CFR 354.300	- •
Contributes	
M containers turind	- Brekelt using All
	Sources criteria.
Eddense af begendeus substance migrafien been container aven (i.e., container aven includes containers and any associated containment absolutes).	·
to Gifty (ir as shifty shistory) amendry customs are	_ 10
The extractes excharges various or out regular important and maintained	_ 16
to entires of hypertess extenses algories have container proc and container area surrounded by sound diving that is regularly immediate and excitations.	•
the collection of homotopic substance exigentian true container area, container area surrelated by second dilate that is regularly improved	9
and administration to the second seco	
(b) Thereally imperious trace enter-container area with figures collection and removal system	- 7
(b) Containing sprior includes essentially improvious been, liquids collection system, sufficient expectly to carried 10 percent of volume of all containing, and functioning and maintained non-on control, and splitted or hadred beautifus authorized and accountained.	5
problems amount to finely regerny to proved employ of colection system, at least weekly impaction of continues, humanism	,
substitutes in facility or detailerating custainess transferred to committees in good condition, and containers seemed except when	1 :
with a gift or gamen.	s s
(c) Proc Spids present, containment system has sufficient capacity to hold total volume of all containers and to provide adopted feedbased, and shade floor under consister and with feedbases backers collection and unmost custom below that.	•
bankaged, and single ther yeater exercises upon with functioning teachests collection and removed system below that. (4) Same or (4) execut deaths their contents once with functioning teachests collection and received system between their	3
Contained builds or under registalmed induct attracture that provides protection from proceeduries as that makes morall nor function would	•
to granted from any extended or replaced containers, liquids or meterials containing tree liquids not deposited in any container, and functioning and making-lead non-on control present.	
to column of humanius industries migration from container area, containers leading, and of fee figuids eliminated at choose (either by	Evaluatio uning All
removal of Equits or suffillication of remaining wants and wants residues;	Sources criteria
remarked of Equility or suffillication of remarking wantes and weste residues;	Sources caloring (with me bulk or fre
removal of lights or solidification of remaining wantes and wests residues).	Sources criteria
removal of liquids or solidification of remaining wantes and waste residues). Tank	Sources coherie (militare bulk or fre Equide deposited).
removal of liquids or solidification of remaining wantes and waste residues). Tank	Sources criteria (with no bulk or fre
Torik Editors of hypothese substance migration from task area (i.e., suck area includes tank, stollary equipment such as piping, and any	Sources colorie (with the bulk or fre Equite deposited). Establishe using All Sources colorie
Tank Figure of hypothese substance migration from tests and waste residues). Figure Editorian of hypothese substance migration from tests area (i.e., suck area includes tests, anothery equipment such as piping, and any accordance contributes such as piping.	Sources colorie (with the bulk or fre Equite deposited). Establishe using All Sources colorie
Tank Tank Finds Find	Sources colorie (with the bulk or fre Equite deposited). Establishe using All Sources colorie
Tools Tools Final	Sources crisels (mitres buth or fre Equits deposited). Evaluate using All Sources criteria 10
Tyric Figure Figure Figure Figure Figure Figure Fidures of humanists substance migration from tasts area (i.e., such area includes tasts, sectlary equipment such as piping, and are accordated containment structures). The deling (or no shaller structure) emirated track and encountry equipment Thing commanding tasks and enablery equipment unarrand or not regularly impocined and containment. The collection of filterations delictance migration from tasts area and tasts and ancillary equipment commanded by sound diving that in regularly impacted and maintained.	Sources crisels (mitres test or fre figures deposited). Evaluate uning All Sources criteria 10
Tork Figure of humaning substance migration from task area (i.e., task area includes task, profilery equipment such as piping, and are associated contributed the directions). The dilarge of humaning substance migration from task area (i.e., task area includes task, profilery equipment such as piping, and are associated contributed the charge of including task and encillary equipment. Thing differentially task and enablary equipment unassed or not regularly imported and maintained. The obligates of humaning tasks area migration from task area and task and ancillary equipment consumed by sound dilarge that is regularly imported and maintained.	Sources criteria (mitr no bulk or fre Equins deposited). Evaluate uning All Sources criteria 10
Tank Took Final Fi	Sources crisels (mitros tests or fre Equids deposited). Evaluate using All Sources criteria 10 10 10
Took First Fir	Sources calusis (with rea budt or fre liquids deposited). Evaluate using All Sources calusin 10 10 9 9
Toric Figure of humanines exhibitation of remaining wastes and weste residues). Figure of humanines exhibitation injustion from tasts area (i.e., tasts area includes tasts, studiesy equipment such as piping, and any associated contributation transferring task and excelling opposite and exhibitation and exhibitation of instructions tasks and excelling opposite and excelling contributed. Thing distributed give and exhibitation eviposition from tasts area and tasts and ancillary equipment summended by sound diving that is engalishy impacted and maintained. The exhibitation of interestions exhibitation originalises from tasts area, tasts and ancillary equipment surrounded by sound diving that is expelled, inspected and exhibitation, and: (a) Tasts and excellence exhibitation.	Sources calusis (with rea budt or fre liquids deposited). Evaluate using All Sources calusin 10 10 9 9
Tank Total Tot	Sources calorie (mitres bulk or fre Equits deposited). Evaluate using AB Sources calorie 10 10 10 9
Tyric Tyric Tyric Tyric Evidence of humations substance migration from tests area (i.e., such area includes tests, sectlary equipment such as piping, and are associated contributed tests. This delive (ir no similar structure) substance migration from tests area projected and resistance. This associates of humations substance migration from tests area and tests and ancillary equipment summended by sound diving that is regularly impacted and maintained. The evidence of humations substance migration from tests area and tests and ancillary equipment summended by sound diving that is regularly impacted and maintained, such that is required to an accidence of humations substance migration from tests area, tests and ancillary equipment provided with secondary containment (c.g., from under tests area, vasit system, double-well) with lead detection and collection system. (b) Tests and ancillary equipment provided with secondary containment system that detects and collects spilled or funded humation substances and accommission provided with secondary containment system that detects and collects spilled or funded humations substances and accommission provided with secondary containment system that detects and collects spilled or funded humation substances and accommission provided with secondary containment system that detects and collects applied or funded humation substances and accommission of values of largest tests within openitional order.	Sources calorie (miltree bulk or for Equits deposited). Evaluate using All Sources calorie 10 10 10 7
Tyric Tyric Tyric Tyric Evidence of humations substance migration from tests area (i.e., such area includes tests, sectlary equipment such as piping, and are associated contributed tests. This delive (ir no similar structure) substance migration from tests area projected and resistance. This associates of humations substance migration from tests area and tests and ancillary equipment summended by sound diving that is regularly impacted and maintained. The evidence of humations substance migration from tests area and tests and ancillary equipment summended by sound diving that is regularly impacted and maintained, such that is required to an accidence of humations substance migration from tests area, tests and ancillary equipment provided with secondary containment (c.g., from under tests area, vasit system, double-well) with lead detection and collection system. (b) Tests and ancillary equipment provided with secondary containment system that detects and collects spilled or funded humation substances and accommission provided with secondary containment system that detects and collects spilled or funded humations substances and accommission provided with secondary containment system that detects and collects spilled or funded humation substances and accommission provided with secondary containment system that detects and collects applied or funded humation substances and accommission of values of largest tests within openitional order.	Sources calorie (miltree bulk or for Equits deposited). Evaluate using All Sources calorie 10 10 10 7
Tank Tourit	Sources calorie (miltren bulk or fre Equits deposited). Evaluate using AB Sources calorie 10 10 10 9
Tork Tork Evidence of humanines substance migration from texts once (i.e., texts once includes texts, sectlary equipment such as piping, and any associated coordinated structural). But dilary (or no similar structural) conformating texts and excelleny equipment. Dilary constructed substance migration from texts once and texts and ancillary equipment contented. The coldinate of humanines substance migration from texts once and texts and ancillary equipment summended by sound dilary that is requirely impracted and maintaines. The coldinate of humanines substance migration from texts once, texts and ancillary equipment summended by sound dilary that is requirely impracted and maintained, and: (a) Tank and ancillary equipment provided with secondary containment (e.g., text under texts area, vest system, double-well) with leaf distraction and conformation provided with secondary containment system that detects and collects spilled or hadred humanines substances and accumulated provided with secondary containment system that detects and collects spilled or hadred humanines and accumulated provided with secondary containment system (e.g., text systems of veture of largest text with appraction of texts and excellent expenses, at their weathy impraction of texts and excellent expenses, at their veture largest excellent excelle	Sources calarie (mitres tealt or fre Equits deposited). Evaluate using All Sources calarie 10 10 9
Tank Total Tot	Sources calable (mitres tests or fre Equits deposited). Evaluate using All Sources calable 10 10 9 7 5 5 5 3
Toric Figure of humations substance migration from texts area (i.e., texts area includes texts, sectlary equipment such as piping, and any associated contributed structural). But dilling (at no shallow structural) texts and excelling equipment. Thing distracting texts and exallory equipment unatural or not regularly impacted and resistated. The coldinate of humations substance migration from texts area and texts and ancillary equipment summended by sound dilling that is regularly impacted and maintained. The coldinate of humations substance migration from texts area, texts and ancillary equipment summended by sound dilling that its migration and maintained, and: (a) Texts and excelling equipment provided with secondary containment (e.g., text under texts area, vest system, double-well) with lead distraction and conficultion system. (b) Texts and excelling equipment provided with secondary containment system that detects and collects system, double-well) with lead distractions and excelling equipment provided with secondary containment system that detects and collects system of buyers text within appealment only an excellent expension of texts and excellent expension and manufactures and excellent expension of texts and excellent expension that form texts are texts and excellent expension that system and extension and excellent expension and excellent expension and excellent expension and excellent expension that excellent excellent excellent and excellent excellent excellent excellent excellent excellent and excellent between these excellent e	Sources calarie (mitres teath or free Equits deposited). Evaluate using All Sources calerie 10 10 10 9

Rainfall. Determine the 2-year. 34-hour rainfall for the site. Use site-specific, 2-year, 34-hour rainfall data if records are available

for at least 20 years. If such site-specific data are not available, estimate the 2-year, 21-hour nearest integer. rainfall for the site from a rainfall-frequency

Drainage area. Determine the drainage area for the sources at the site. Include in this drainage area both the sources areas and the area upgradient of the sources, but exclude any portion of this drainage area for which runoff is diverted from entering the sources by storm sewers or run-on control and/or runoff management systems. Assign a drainage area value for the watershed from Table 4-3.

Soil group. Based on the predominant soil group within the drainage area described above, assign a soil group designation for the watershed from Table 6-4 as follows:

Select the predominant soil group as that type which comprises the largest total area within the applicable drainage area.
 If a predominant soil group cannot be

 If a predominant soil group cannot be delineated, select that soil group in the drainage area that yields the highest value for the renoff factor.

Calculation of remoff factor value. Assign a combined rainfall/runoff value for the watershed from Table 4-5, based on the 2-year, 24-hour rainfall and the soil group designation. Determine the runoff factor value for the watershed from Table 4-6, based on the rainfall/runoff and drainage area values. Enter the runoff factor value in Table 4-1.

TABLE 4-3.—DRAINAGE AREA VALUES

Orainege area (acres)	Assigned value
Less than 5050 to 250	1 2
Circular than 250 to 1,000	3

TABLE 4-4.—SOIL GROUP DESIGNATIONS

Surface soil description	Solt group designation
Coarse-textured soils with high infil- tration rates (for example, sands,	٨
loamy sands). hisdium-textured soils with moderate infiltration rates (for example, sandy fears, loanes).	. 8
Moderately fine-tendured solls with low infiltration rates (for example, sitty forms, sitty forms).	С
Fine-textured soils with very low infi- tration rates (for example, clays, sendy clays, sity clay loams, clay towns, sity clays); or impermeable surfaces (for example, pevernent).	D

TABLE 4-5.-RAINFALL/RUNOFF VALUES

2-Year, 24-hour rainfall	rainfait Soil group designet						
(inches)	A	В	C	D			
Less then 1.0	0	0	2	3			
1.0 to less than 1.5	0	1	2) 3			
1.5 to less then 2.0	0	2	3	4			
20 to less then 2.5	1	2	3	. 4			
25 to less than 3.0	2	3	4.	4			
3.0 to less then 3.5	·2	3	4	5			
3.5 or greater	3	1 4	5	\ ē			

TABLE 4-6.—RUNOFF FACTOR VALUES

Drainage	Rainfall/runoff value								
value	0	-	2	3	4	5	·		
1 2 34	0000	0 0 0 1	0 1 1 2	1 1 3 7	1 2 7 17	1 3 11 25	1 4 15 25		

4.1.2.1.2.1.3 Distance to surface water as the shortest distance, along the overland segment, from any source with a surface water containment factor value greater than 0 to either the mean high water level for tidal waters or the mean water level for other surface waters. Based on this distance, assign a value from Table 4–7 to the distance to surface water factor for the watershed. Enter this value in Table 4–1.

4.1.2.1.2.1.A Calculation of factor value for potential to release by overland flow. Sum the factor values for ranoff and distance to surface water for the watershed and multiply this sum by the factor value for containment. Assign the resulting product as the factor value for potential to release by overland flow for the watershed. Enter this value in Table 4-1.

4.1.2.1.2.2 Potential to release by flood.

Evaluate potential to release by flood for each watershed as the product of two factors: containment (flood) and flood frequency.

Evaluate potential to release by flood separately for each source that is within the watershed. Purthermore, for each source, evaluate potential to release by flood separately for each category of floodplain in which the source lies. (See section 4.1.2.1.2.2.2 for the applicable floodplain categories.)

Calculate the value for the potential to release by flood factor as specified in 4.1.2.1.2.2.3.

4.1.2.1.2.2.1 Containment (flood). For each source within the watershed, separately evaluate the containment (flood) factor for each category of floodplain in which the source is pertially or wholly located. Assign a containment (flood) factor value from Table 4-8 to each floodplain category applicable to that source. Assign a containment (flood) factor value of 0 to each floodplain category in which the source does not lie.

in which the source does not lie.
4.1.2.1.2.2.2 Flood frequency. For each source within the watershed, separately evaluate the flood frequency factor for each category of floodplain in which the source is pertially or wholly located. Assign a flood frequency factor value from Table 4-8 to each floodplain category in which the source is located.

4.1.2.1.2.2.3 Calculation of factor value for potential to release by flood. For each source within the watershed and for each category of floodplain in which the source is partially or wholly located, calculate a separate potential to release by flood factor value. Calculate this value as the product of the containment (flood) value and the flood frequency value applicable to the source for the floodplain category. Select the highest value calculated for those sources that meet the minimum size requirement specified in section 4.1.2.1.2.1.1 and assign it as the value

for the potential to release by flood factor for the watershed. However, if, for this watershed, no source at the site meets the minimum size requirement, select the highest value calculated for the sources at the site eligible to be evaluated for this watershed and assign it as the value for this factor.

TABLE 4-7.—DISTANCE TO SURFACE WATER FACTOR VALUES

Distance	Assigned value
Less than 100 feet	25 20 16 9 6

TABLE 4-8.—CONTAINMENT (FLOOD)
FACTOR VALUES

Containment criteria	Assigned value
Documentation that containment at the source is designed, construct- ed, operated, and maintained to prevent a weshout of hazardous substances by the flood being eval-	0
veled. Other	10

TABLE 4-9.—FLOOD FREQUENCY FACTOR
VALUES

Floodplain category	Assigned value
Source floods annually	50 50 25 7 0

Enter this highest potential to release by flood factor value for the watershed in Table 4-1, as well as the values for containment (flood) and flood frequency that yield this highest value.

4.1.2.1.2.3 Calculation of potential to release factor value. Sum the factor values assigned to the watershed for potential to release by overland flow and potential to release by flood. Assign this sum as the potential to release factor value for the watershed, subject to a maximum value of 500. Enter this value in Table 4-1.

4.1.2.1.3 Calculation of drinking water threat-likelihood of release factor category value. If an observed release is established for the watershed, assign the observed release factor value of 550 as the likelihood of release factor category value for that watershed. Otherwise, assign the potential to release factor value for that watershed as the likelihood of release factor category value for that watershed. Enter the value assigned in Table 4-1.

4.1.2.2 Drinking water threat-waste characteristics. Evaluate the waste characteristics factor category for each

standard based on him flatters tenicity/ mistance and I restribus waste quantly whate only these basedons substance of one ovalidate to signate from the sou ship to salgrate from the nations region in the wate natifical homodous subgration path for the watershed (see sacti rus substances include: 4111) Sublement

4.1.1.1. Were intensive substances include • Elementous substances what must the culturie for an elementy-element to surface water in the watershiel.
• All homodyne substances processed

anjudous substances; panetist was that has a parlogs septer confidence factor value greater than 6 the wetershed juny sections 222, 223, 41,23,211, and 41,812,21). on 4 fee

412.21. Well 412.22.).

412.21. Punicip/parabitance. For each hamselous substance, seeign a twicky fector value, a parabitance factor value, and a combined twicky/punicipance factor value as specified in sections 4.1.2.2.1.1 through 4.1.2.2.1.2. Select the tenticity/punicipance factor value for the unstanded as specified in section 4.1.2.2.1. 0412211

4.1.2.2.1.1 Thereby. Annign a tentisty factor value to each humardous substance specified in section 2.4.2.1. -

43.2.2.2. Persistence. Assign a sepirtance factor value to each leasurdons whetence. In unsigning this value, evaluate existence based palmonthy on the half-life of in homodons unbelgage in exclusive value. to bestednes substante in outfloor wet all reconductly on the corption of the accordence substance to endinents. The fe in symfoor water is defined for HRS es. The helfone in summer wear is assumed for times purposes as the time sequined to reduce the initial concentration in surface water by one half as a stock of the combined decay processes of biologradution, hydrolysis, photolysis, and velotifization. Secysion to

to in confusion for the LECS based at the logarithm of the z -actual -votes portition coefficient (log $K_{\rm pol}$) of the hazzerdoun

Entirete the half-life (t_{n/2}) of a horardous substance as follows:

$$b_{j2} = \frac{1}{1 \quad 1 \quad 1}$$

$$b \quad b \quad p \quad \nabla$$

b = Hydrolysis helf-life. b = Medagradeten helf-life. p = Photolysis helf-life. v = Volatilization helf-life.

If one or more of these four cohalf-lives cannot be estimated for the insurince substance from available data, delete that compensat half-life from the above equation. If name of these four enouganns half-lives can be estimated for the rdone substance from evallable data, use the defenit precedure indicated below. Estimate a half-life for the hazardoss substance for labor or for rivers, occurs, counts, counts (idel waters, and Greet Lakes, as

If a half-life can be estimated for a

in a new-per cap or a community per a handeless substance a paraistence factor value from the appropriate person of Table 4-30 (dust to laker; or civers, econos, constal tidal waters, and Goest

• Select the appropriate portion of Table 4-10 as follows:

-If there is one or more drinking water Antibes along the hanneless substance migration path for the watershot, solicit the measure drinking water disting water of from the probable ---sint of entry. If the in-water segu streets the probable point of est of this selected intoles includes t shile point of eartry e and other water bedies, are the us parties of Table 4-16 only if se than half the distance to this seted intole lies in belock). es, was the sire al tidal waters, and Great Lakes portion of Table 4-18. For etal sellensis vila se identified source, use the point where measurement heplac (see section 4.3.3.2) rather than the probable point

of enty.

If there are no disking water intakes
but there are littakes or points of use
for any of the seconds types litted in
section 41.233, solect the assess such
intuke or point of win. Select the parties of Table 4-30 based on this

parties or paint of use in the monuter specified for detailing water intakes.

If these are no detailing water intakes and no specified resource intakes and paints of use, but there is another type of resource listed in section 4.1.2.3.3 of resource listed in section 4.2.2.3 (for example, the water is usable for drinking water purposes even though not used), select the parties of Table 4-10 based on the necesst point of this resource in the measure specified for drinking water intoken

TABLE 4-10.—PERSISTENCE FACTOR VALUES—HALF-LIFE

Surface wells category	Schulance half-life (days)			
Floren, economic country Sód waters, and Grand Labor	Loss than or equal to 0.2 Greater than 0.2 to 0.5 Greater than 0.5 to 1.5 Greater than 1.5	0.0007 0.07 0.4		
Cales	Loss their or equal to 0.02 Greater their 0.02 to 2 Greater their 2 to 20 Greater their 20	0.6007 0.607 0.4 1		

[&]quot;Do not round to represt integer.

If a half-life cannot be estimated for a hezardous substance from evallable data, use the following definit procedure to assign a paraletence factor value to that hazardous

- . For these hamelous substances that are motals (or matalisids), assign a persistance factor value of 1 as a default for all surface mater bodies.
- For other handoes substances (both genic and inequalc), easign a persistance ener value of 0.4 as a default for rivers. us, constal tidel waters, and Great Lakes, and a persistence factor value of 0.07 es a default for lakes. Select the appropriate value in the same measur specified for sping Table 4-30.

Use the paraistance factor value assigned bees," on helf-life or the default procedure unless the least-does substance can be assigned a higher factor value from Table designate a segment sector ventre from 1 actor de-11, bessel on its Log K_{ee}. If a higher value can be assigned from Table 4-21, assign this higher value as the pessistence factor value for the hazzadous substance.

TABLE 4-11.—PERSISTENCE FACTOR VALUES-LOG K_

Log K.	Assigned
Lens than 1.5	0.0567
15 to less than 4.0	9.07

TABLE 4-11.—PERSISTENCE FACTOR VALUES-LOG K ...- Concluded

Log K.,	Assigned value*
Greater than 4.5	1

"Use for lates, minute, occupies, counted little uting, and Great Lates. Do not round to necresi

412213 Calculation of toxicity/ persistence factor value. Assign each hazardous substance a texicity/persistence factor value from Table 4-12, based on the values essigned to the hezardous substance for the taxicity and persistence factors. Use

the hazardous substance with the highest toxicity/persistence factor value for the watershed to assign the toxicity/persistence factor value for the drinking water threat for the watershed. Enter this value in Table 4-1.

4.1.2.2.2 Hazardous waste quantity. Assign a bazardous waste quantity factor value for the watershe's as specified in section 2.4.2 Enter this value in Table 4-1.

4.1.2.3 .Calculation of drinking water threat-waste characteristics factor categor value. Multiply the toxicity/persistence an hazardous waste quantity factor values for the watershed, subject to a maximum product

of 1 x 10°. Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the drinking water threat-waste characteristics factor category for the watershed. Enter this value in Table 4-1.

TABLE 4-12.—TOXICITY/PERSISTENCE FACTOR VALUES *

	Toxicity factor value						
Parsistence factor velve	.10,000	1,500	100	10	1	0	
10	10,000	1,000	160	10	1	L.	
0.4,	4,000 700		40 4 7 07	4	0.4	0	
0.0007	7	0.7	0.07	0.007	0.0007	ő	

^{*}Do not round to nearest integer.

4.1.23 Drinking water threat-targets. Evaluate the targets factor category for each watershed based on three factors: nearest intake, population, and resources. To evaluate the measest intake and

population factors, determine whether th target surface water intakes are subject to actual or notestial contamination as specified in section 41.1.2. Use either an observed use bused on direct observation at the intake or the exposure concentrations from samples (or comparable samples) take beyond the intake to make this determ m at or (see section 4.1.2.1.1). The exp concentrations for a sample (that is, surface water, beathic, or sediment sample) consist of the concentrations of those hazardous substances present that are significantly above background levels and attributable at least in part to the site (that is, those hazardous substance concentrations that meet the criteria for an observed relea When an intake is subject to actual

contamination, evaluate it using Level I.

concentrations or Level II concentrations. If the actual contamination is based on an observed release by direct observation, use Level II concentrations for that intake. However, if the actual contamination is based on an observed release from sar determine which level applies for the intake by comparing the exposure concentrations from samples (or comparable samples) to health-based benchmarks as specified in sections 2.5.1 and 2.5.2. Use the health-bas enchmarks from Table 3-10 (section 3.3.1) in determining the level of contamination from ples. For contaminated sediments with no identified source, evaluate the actual contamination using Level II concentrations [see section 4.1.1.2].

41231 Nearest intake. Evaluate th nearest intake factor based on the drinking water intakes along the overland/flood hazardous substance migration path for the watershed. Include standby intakes in evaluating this factor only if they are used for supply at least once a year. Assign the nearest intake factor a value as s and enter the value in Table 4-1:

 If one or more of these drinking water stakes is subject to Level I concentrations as specified in section 4.1.2.3, assign a factor value of 50.

· If not, but if one or more of these drinking water intakes is subject to Level II concentrations, assign a factor value of 45.

· If none of these drinking water intakes is subject to Level I or Level II concentrations, determine the meanest of these drinking water intakes, as measured from the probable point of entry (or from the point where measurement begins for contaminated sediments with no identified source). Assign a dilution weight from Table 4–13 to this intake, based on the type of surface water body in which it is located. Multiply this dilution weight by 20, round the product to the nearest integer, and assign it as the factor

Assign the dilution weight from Table 4-13 as follows:

TABLE 4-13.—SURFACE WATER DILUTION WEIGHTS

Type of surface water body *				
Descriptor	Flow characteristics			
Mining! streets				
inal to moderate stream				
loderate to targe atream				
arge streem to river	Greater than 1,000 to 10,000 cfs			
ery targe river	Greater then 10,000 to 100,000 cfs.			
constal fidel waters 4				
hallow ocean zone" or Great Lake				
loderate depth ocean zone or Great Lake		0.00001		
	Flow not applicable, depth greater than 200 feet	0.00000		
-mile mixing zone in quiet flowing river	10 cls or greater	0.5		

- *Treat each lake as a separate type of water body and assign a dilution weight as specified in text.

 *Do not round to nearest integer.

 *cts = cubic feet per second.
- *Emblyments, harbors, sounds, astuaries, back bays, legoons, wetlands, etc., seeward from mouths of rivers and lendward from baseline of Territorial Sea.

 *Seaward from baseline of Territorial Sea. This baseline represents the generalized U.S. coastline, it is perallel to the seaward first of the Territorial Sea and other maritime limits such as the inner boundary of the Federal disheries jurisdiction and the first of States jurisdiction under the Submerged Lands Act, as amended.
- For a river (that is, surface water body types specified in Table 4-13 as minimal stream through very large-river), assign a dilution weight based on the average annual flow in the river at the intake. If available,

use the average annual discharge as defined in the U.S. Geological Survey Water Resources Data Annual Report. Otherwise. estimate the average annual flow.

- . For a lake, assign a dilution weight as follows:
 - -For a lake that has surface water flow entering the lake, assign a dilution weight based on the sum of the

average annual flows for the surface

water hedits outsting the lake up to the point of the intake. For a lake that has no surface water flow enturing, but that does have surface water flow leaving, assign a mion weight boood on the sum of the average attenued flows for the surface water bedies leaving the lake.

- Per a closed lake (that in, a lake without surface water flow entering or having), orign a dilution weight based on the process accord ground water flow let the lake, if available, using the dilute ad water flow jate veight for the corresponding river flow rate in Table 6-13. If not evalishin, andgo a defealt dilution veight of 1.

. For the ocean and the Great Labor.

reign a difetire weight based on depth.

• For countal tidal waters, assign a dife eight of 0.000; do not consider depth or

 For a quiet-Borring siver that has an exact flow of 10 cobic fast per second; annual flow of 20 orbic fact per second (c) or greater and their contains the probable point of entry to arcticce water, apply a su of mixing in conigning the dilution weight:

Surt the state of mixing at the prob-point of entry and extend it for 3 m from the probable point of energ. el it for 3 miles point or formation pro-from the probable pro-encupt if the confect wat minister change to characteristics change to terbulant within this 3-mile distance, extend the

tion of mixing only to the point at which the change occurs. raign a dilution weight of 0.5 to any major that lies within this some of

Strong.

-Beyond this stone of mixing, conign a distant weight the stone on for any other river phot is, easign the disalt weight based on average annual florable opinish disalter with an

Dreat a quiet-Bowing river with an average cannol Bow of less than 10 cls the same as any other river (that is, assign it a dilution weight of 1).

mongs x a unation weight of 1).
those cases where weigh flower from a prince water body with a lower assigned latter weight flown Table 4-13) to a surface ster body with a higher assigned distion sight (that is, water flows from a surface ster body with more dilution to one with so dilution), use the lower assistant dilution. Minima), use the lower assigned diluti ht as the dilution weight for the latter

41232 Population in evaluating the ion factor, include only pers rved by drinking water drawn from intoles that are along the overland/flood becordens substance migration path for the watershed and that are within the target distance limit published in section 4.1.1.2. Include residents. students, and workers who regularly use the water. Exclude transient populations such as customers and travelers per sing through the area. When a standby intake is maintained on a regular basis so that water can be withdrawn, include it in evaluating the population factor.

population factor.

In estimating residential population, when the estimate is based on the sember of residence, multiply each residence by the average number of persons per residence for the county in which the residence is located.

In estimating the population served by an intake, if the water from the intake is blands la esti with other water (for example, water from other section water intakes or ground water selled american the total population other surface water manufactures wells], apportion the total population wells], apportion the blended system to the intake based on the intake's relative intake based on the intract a resource, contribution to the total blooded system. In estimating the intake's relative con arrenne each well or intake contributes equally and apportion the population accordingly, except if the relative contribution of any one intake or well n of any one intake or wall entrods 40 percent based on everage as pumpage or capacity, estimate the relative contribution of the wells and intakes considering the following data, if available:

Average manual pumpage from the ground water wells and surface water intoless in the blanded system.

· Capacities of the wells and intakes in the blanded system.

For systems with standby surface we inteles or standby ground water wells, opportion the total population regularly served by the blended system as described

* Buchele standby ground water wells in apportioning the population.

When the purpose data for a standby author water intake, use overage pumpage for the period during which the standby intake is used rother than average amount

* For that partion of the total population that could be appartioned to a standby surface water intake, assign that portion of

the population either to that standby intake or to the other surface water intake(s) and or to the other surface water intake(s) and ground water well(s) that serve that population; do not assign that partion of the population both to the standby intake and to the other intake(s) and well(s) in the bletded system. Use the apportioning that results in the highest population factor value. (Either include all standby intake(s) or exclude some or all of the standby intake(s) as assertoriate include all standby intake(s) or exclude some or all of the standby intake(s) as appropriate to obtain this highest value.] Note that the specific standby intake(s) included or excluded and, thus, the specific apportioning any vary in evaluating different vestersheds and in evaluating the ground water pathway.

4.12.3.2.1 Lovel of contamination.

Brailett the population factor based on three factors: Level II concentrations. Level II concentrations.

concentrations, and potential cont Determine which factor applies for an intake as specified in section 4.1.2.5. Evaluate intakes as the section 4.1.2.5. s subject to Level I concentration as specified in section 4.12.5.22, intakes subject to Level II concentration as specified in section 4.12.5.23, and intakes subject to potential contentation as specified in erries A1212A

Per the potential continuination factor, we population ranges in evaluating the factor as specified in section 4.1.2.3.2.4. For the Level I specified in section 4.2.2.0.0.1 was the seed Level III concentrations factors, use the population ranges, in evaluating both factors.

A.1.2.3.22 Level I concentrations. Sum the number of people served by drinking water from intulus subject to Level I concentrations. Multiply-this sum by 10.

Assign this product on the value for this r. Enter this value in Table 4-1. fore

4.123.23 Level II concentrations. Sum the number of pusple served by drinking water from jetakes subject to Level II concentrations. Do not include po-aironly counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table

4.1.2.3.2.4 Potential contamination. For such applicable type of surface water body in table 4.14 first determine the number of Table 4-14, first mine the number of people served by drinking water from intakes subject to potential contamination in that type of surface water body. Do not include these people already counted under it and Level II concentrations factors. and under the Level PELLING COME (SIN-IN-III

TABLE 4-14
DILUTION-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FACTOR FOR SURFACE WATER HIGRATION PATHWAY®

•		Number of People							
Type of Surface Water Bodyb	0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000
Minimal stream (< 10 cfs)	0	4	17	53	164	522	1,633	5,214	16,325
Small to moderate stream (10 to 100 cfs)	0	0.4	2	5	16 ,	52	163	521	1,633
Moderate to large stream (> 100 to 1,000 cfs)	0	0.04	0.2	0.5	. 2	5	16	52	163
Large stream to river (> 1,000 to 10,000 cfs)	0	0.004	0.02	0.05 -	0.2	, 0.5	2	5	16
Large river (> 10,000 cfs)	0	o ·	0.002	0.005	0.02	0.05	0.2	0.5	2
/ery large river (> 100,000 cfs)	0	0	0	0.001	0.002	0.005	0.02	0.05	0.2
hallow ocean zone or Great ake (depth < 20 feet)	0	٥	0.002	0.005 .	0.02	0.05	0.2	0.5	2
oderate ocean zone or Great ake (depth 20 to 200 feet)	0	0	0	0,001	0.002	0.005	.0.02	0.05	0.2
Deep ocean zone or Great Lakes (depth > 200 feet)	. 0 .	0	0	0	0.001	0.303	0.008	0.03	0.0
-mile mixing zone in uiet flowing river ≥ 10 cfs)	.0	2	9	26	82	261	817	2,607	8,163

	Number of People					
Type of Surface Water Bodyb	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000	3,000,001 to 10,000,000	
Minimal stream (< 10 cfs)	52,137	163,246	521,360	1,632,455	5,213,590	
Small to moderate stream (10 to 100 cfs)	5,214	16,325	52,136	163,245	521,359	
Moderate to large stream (> 100 to 1,000 cfs)	521	1,633	5,214	16,325	52,136	
Large stream to river (> 1,000 to 10,000 cfs)	32	163	521	1,632	5,214	
Large river (> 10,000 to 100,000 cfs)	5	16	52	163	521	
Vary large river (> 100,000 cfs)	0.5	2	5	16	52	
Shallow ocean zone or Great Lake (depth < 20 feet)	5	16	52	163	521	
Moderate ocean zone or Great Lake (depth 20 to 200 feet)	0.5	. 2	5	16	52	
Deep zone or Great Lake (depth > 200 feet)	0,3	1	3	8	26	
3-mile mixing zone in quiet flowing river (≥ 10 cfs)	26,068	81,623	260,680	816,227	2,606,795	

ARound the number of people to nearest integer. Do not round the assigned dilutionweighted population value to nearest integer.

bTreat each lake as a separate type of water body and assign it a dilution-weighted population value using the surface water body type with the same dilution weight from Table 4-13 as the lake. If drinking water is withdrawn from coastal tidal water or the ocean, assign a dilution-weighted population value to it using the surface water body type with the same dilution weight from Table 4-13 as the coastal tidal water or the ocean zone.

For each type of surface water body, assign a dilution-weighted population value from Table 4-14, based on the number of people included for that type or surface water body. (Note that the dilution-weighted population values in Table 4-14 incorporate the dilution weights from Table 4-13. Do not multiply the values from Table 4-14 by these dilution weights.)

Calculate the value for the potential contamination factor (PC) for the watershed as follows:

$$PC = \frac{1}{10} \sum_{i=1}^{n} W_{i}$$

W₁=Dilution-weighted population from Table 4-14 for surface water body type i. n=Number of different surface water body types in the watershed.

If PC is less than 1, do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Enter this value for the potential contamination factor in Table 4-1.

4.1.2.3.2.5 Calculation of population factor value. Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this um to the nearest integer. Assign this sum as the population factor value for the watershed. Enter this yake in Table 4-1.

41.233 Resources. To evaluate the resources factor for the watershed, select the highest value below that applies to the watershed. Assign this value as the resources factor value for the watershed. Enter this value in Table 4-1.

Assign a value of 5 if, within the in-water segment of the hazardous substance migration path for the watershed, the surface water is used for one or more of the following

- hrigation (5 acre minimum) of commercial food crops or commercial forage
- Watering of commercial livestock.
- · Ingredient in commercial food
- Major or designated water recreation area, excluding drinking water use.

 Assign a value of 5 if, within the in-water

segment of the hazardous substance migration path for the watershed, the surface water is not used for drinking water, but either of the following applies:

- Any portion of the surface water is designated by a State for drinking water use under section 305(a) of the Clean Water Act, as amended.
- Any portion of the surface water is usable for drinking water purposes.

Assign a value of 0 if none of the above applies.

4.1.2.3.4 Calculation of drinking water threat-targets factor category value. Sum the nearest intake, population, and resources factor values for the watershed. Do not round this sum to the nearest integer. Assign this sum as the drinking water threat-targets factor category value for the watershed. Enter this value in Table 4-1.

4.1.2.4 Calculation of the drinking water threat score for a watershed. Multiply the

drinking water threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting valu subject to a maximum of 100, as the drinking rater threat score for the watershed. Enter this value in Table 4-1.

4.1.3 Human food chain threat. Evaluate the human food chain threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.3.1 Fluman food chain threat-likelihood of release Assign the same likelihood of release factor category value for the human food chain threat for the watershed as would be assigned in section 4.1.2.1.3 for the drinking water threat. Enter

this value in Table 4-1.
4.1.3-2 Human food chain threat-waste characteristics. Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/ persistence/bioaccumulation and hazardous waste quantity.

41.3.2.1 Toxicity/persistence/bioaccumulation. Evaluate all those hazardous substances eligible to be evaluated for toxicity/persistence in the drinking water threat for the watershed (see section 4.1.2.2).

4.1.3.2.1.1 Toxicity. Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.1.3.2.1.2 Persistence. Assign a persistence factor value to each hazardous substance as specified for the drinking water threat (see section 4.1.2.2.1.2), except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest fishery (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of Table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2. For contaminated sediments with no identified source, use the point where measurement begins rather than the probable point of entry.

4.1.3.2.1.3 Bioaccumulation potential. Use the following data hierarchy to assign a bioaccumulation potential factor value to each hazardous substance:

Bioconcentration factor (BCF) data.

· Logarithm of the n-octanol-water partition coefficient (log K,...) data.

Water solubility data.

Assign a bioaccumulation potential factor value to each hazardous substance from Table 4-15.

If BCF data are available for any aquatic human food chain organism for the substance being evaluated, assign the bioaccumulation potential factor value to the hazardous substance as follows:

· If BCF data are available for both fresh water and salt water for the hazardous substance, use the BCF data that correspond to the type of water body (that is, fresh water or salt water) in which the fisheries are located to assign the bioaccumulation potential factor value to the hazardous substance.

· If, however, some of the fisheries being evaluated are in fresh water and some are in salt water, or if any are in brackish water, use the BCF data that yield the higher factor value to assign the bioaccumulation potential factor value to the hazardous substance.

. If BCF data are available for either fresh water or salt water, but not for both, use the available BCF data to assign the bioaccumulation potential factor value to the hazardous substance.

If BCF data are not available for the hazardous substance, use log K,, data to assign a bioaccumulation potential factor value to organic substances, but not to inorgenic substances. If BCF data are not available, and if either log K,, data are not available, the log Kow is available but exceeds 6.0, or the substance is an inorganic substance, use water solubility data to assign a bioaccumulation potential factor value.

> TABLE 4-15.—BIOACCUMULATION POTENTIAL FACTOR VALUES *

If bioconcentration factor (BCF) data are available for any aquatic human food chain organism, assign a value as follows:

8CF	Assigned value
Greater than or equal to 10,000	50,000 5,000 500 50 5 0.5

If BCF data are not available, and log K, data are available and do not exceed 6.8. assign a value to an organic hazardous substance as follows (for inorganic hazardous substances, skip this step and proceed to the next):

1.5 to less than 5.5 1.2 to less than 4.5	Assigned value
5.5 to 6.0	50,000
4.5 to less than 5.5	5,000
3.2 to less than 4.5	500
2.0 to less than 3.2	50
0.8 to less than 2.0	5
Less than 0.8	0.5 .

If BCF data are not available, and if either Log Kon data are not available, a log Kon is available but exceeds 6.0, or the substance is an inorganic substance, assign a value as follows:

TABLE 4-15.—BRONCCIANULATION POSSIBLES FACTOR VALUES CONCLUDED

Their solding (mg/l)	***************************************
Less than 25	50,000
25 to 600	5,000
Greater than 500 to 1,000	500
Greater than 1,500	500

If home of-three data are profeship, earlies a stage of the

Do not distinguish between fresh water and salt water in assigning the bisoccumulation potential factor value based on log K_m, or vester solubility date.

If some of these date are available, energy the hexardens substance a bisoccumulation potential factor value of 85.

4.1.3.2.1.4 Culculation of testicity/peculatures/bisoccumulation factor value. Assign each basedous substance a texticity/peculatures factor value from Table 4-12, based on the values assigned to the substance a tenicity/persistence/ Indian factor value from Table bioaccustulation factor value from Table
4-30, based on the values assigned for the
tanicity/positioner and bioaccustulation
potential factors. Use the homeofree
substance with the highest traicity/
possistance/bioaccustulation factor value for
the westershal to easign the value to this
factor. Buter this value to Table 4-1.

BALLISTS CORES CORNOLOS

^{*}De not mand to convent integer.
*See test for use of beninster and subseter BCF

TABLE 4-16
TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES®

Toxicity/ Persistence	Bioaccumulation Potential Factor Value						
Factor Value	50,000	5,000	500	50	5	0.5	
10,000	5 x 10 ⁸	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	
4,000	2 x 10 ⁸	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,090	
1,000	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	
700	3.5 x 10 ⁷	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	
400	2 × 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	200	
100	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50	
70	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35	
40	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴ -	2,000	200	20	
10	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50	5	
7	3.5 x 10 ⁵	3,5 x 10 ⁴ /	3,500	350	. 35	3.5	
4	2 x 10 ⁵	2 x 10 ⁴	2,000	200	20	. 2	
1 1	5 x 10 ⁴	5,809	500	5 0 -	5	0.5	
0.7	3.5 x 10 ⁴	3,500	350	35	3.5	0.35	
0.4	2 x 10 ⁴	2,000	200	20	· · 2 ·	0.2	
0.07	3,590	350	35	3.5	9.35	0.035	
0.007	350	35 %	3.5	0.3	35 0.03	5 0.0035	
0.0007	35	3.5	0.3	0.0	0.00	35 0.00035	
0	0	0	0	. 0	0	0	

^aDo not round to nearest integer.

4.1.3.2 Handers were quarty.
Assign the swar factor value for hazardous works quartly for the watershot as would be assigned in section 4.1.2.2.2 for the drinking water floors. Buter this value in Table 4.1

attigated in section 4.1.2.2 mr use examing venter threat. Bater this value in Table 6-1.
4.1.3.2.3 Culturation of human food chain direct-wate characteristics factor cotagory value. For the humanism substance selected for the watersheld in section 4.1.3.2.4, use in tenticity/posistance factor value and blacocommistion potential factor value as follows to assign a value to the waste characteristics factor catagory. Plest, multiply the tendity/posistance factor value and the humanism waste quantity factor value for the venturaled, soliged to a maximum product of 1×10 °. Then multiply this product by the binaccommission substanta, subject to a tending product, assign a value from Table 2-7 (section 2.4.3.3) to the human food chain threat-waste characteristics factor catagory for the watershell. Bater this value in Table 4-2.

4.1.9.3 Human food chain throat-tacquis. Brohuse two target factors for each watershelt food choin individual and population. For both factors, determine whother the target fisheries are subject to actual or potential human food chain contenters.

Consider a Sahary for parties of a Sahary) within the tempt distance limit of the watershed to be subject to actual human food chain contamination if any of the following analy-

- A horosinus substance having a bioeccumulation potential factor value of 500 or greater in present either in me chierved release by direct observation to the watershall or in a purface water or meliment sample from the watershall at a level that ments the calmin for an observed subsence to the watershall four the observed subsence to the watershall four the observed subsence plant in, it is located of the observed release plant in, it is located of the observed school plant of unity and the ment distant sampling point establishing the observed subsence.
- The fishery is clotted, and a hassishess substance for which the fishery has been closed has been decemented in mi observed release to the uniqueled from the site, and at least a parties of the fishery is within the boundaries of the shearved release.
- * A hereafous substance is prisent in a those remple from an essentially sensile, benefic, human feel chair regardent bean the vetershed at a level that meets the criteria for an observed release to the watershed from the othe, and at least a portion of the fishery is within the branderies of the observed release.

For a fishery that meets any of these three criteria, but that is not -sholly within the boundaries of the shoerved x leave, consider only the portion of the fishery that is within the boundaries of the observed release to be subject to actual human for d chain contamination. Consider the remainder of the fishery within the larget distance limit to be subject to potential food chain contamination.

In addition, consider all other fisheries that are partially or a solly within the target distance limit for the watershed, including fisheries partially or wholly within the boundaries of an observed release for the watershed that do not inset any of the fisce criteria listed above, to be subject to potential human food chain contamination. If only a portion of the fishery is within the target distance limit for the watershed, include only that portion in evaluating the targets factor cotagory.

When a fishery (or parties of a fishery) is subject to actual food chain contamination, determine the part of the fishery subject to Level II concentrations and the part subject to Level II concentrations. If the actual food chain contamination is based on direct observation, evaluate it using Level III concentrations. However, if the actual food chain contamination is based on sampler from the watershed, use these samples from aquatic human food chain expanions as specified below, to determine the part subject to Level II concentrations:

- Determine the level of actual contamination from samples (including tissue samples from essentially sessile, benthic organisms) that uses the criteria for actual food chain contamination by comparing the exposure concentrations (see section 4.1.2.3) from these samples (or comparable samples) to the health-based benchmarks from Table 4-17, as described in section 2.5.1 and 2.5.2. Use only the exposure concentrations for these lacardons substances in the sample (or comparable samples) that most the criteria for actual contamination of the fishery.
- In addition, determine the level of actual contamination from other tissue snaples by comparing the concentrations of hexadeen substances in the tissue samples (or comparable tissue samples) to the healthbased banchaneks from Table 4-17, as described in sections 25.1 and 25.2. Use only those additional tissue snaples and only those hexardous substances in the tissue samples that meet all the following criteria:
 - The tissue sample is from a location that is within the boundaries of the actual food choin contamination for the site (that is, either at the point of direct observation or at or between the probable point of entry and the most distant sample point meeting the criteria for actual food chain contamination).
 - The tissue sample is from a species of equatic human food chain organism that spands extended periods of time within the boundaries of the actual food chain contamination for the site and that is not an essentially sensile, benthic organism.
 - -The hazardous substance is a substance that is also present in a surface water, benthic, or sediment sample from within the target distance limit for the

watershed and, for such a sample, mosts the criteria for actual food chain contemination.

TABLE 4-17.—HEALTH-BASED BENCH-MARKS FOR HAZARDOUS SUBSTANCES IN HUMAN FOOD CHARL

- Concentration corresponding to Food and Drug Administration Action Level (FDAAL) for Sob or shellfish.
- Screening concentration for cancer consuppeading to that concentration that corresponds to the 10⁻⁰ individual cancer risk for east exposures.
- Screening concentration for neacenter terriculogical surposess corresponding to the Reference Date (RED) for scal exposures.
- 4.1.3.3.1 Poof chain individual Braluste the food chain individual factor based on the lishation (or portions of fishintiss) within the legat distance limit for the watershed. Assign this factor a value as follows:
- If any linkery (or parties of a fishery) is subject to Level I concentrations, assign a value of St.
- If not, but if any linkery (or portion of a linkery) in subject to Level II concentrations, assign a value of 45.
- If not, but if there is an observed release of a humanism substance having a bioaccumulation poteintal factor value of 500 or greater to surface water in the vestetahed and there is a fishing (or portion of a fishery) present anywhere within the target district limit, nation a value of 50.
- and there is a listary for portion of a labery)
 present engwhere within the target districe
 limit, notign a value of 28.

 If there is no observed release to surface
 water in the watershed or these is no
 abserved release of a bezaptous substance
 having a biosecomulation potential factor
 value of 500 or greater, but there is a fallery
 (or parties of a fishery) present anywhere
 within the target distance limit, assign a
 value as follows:
 - -Using Table 4-23, determine the highest dilution weight (that in, lowest amount of dilution) applicable to the fisheries (or partieus of fisheries) within the tagust distance limit. Multiply, this dilution weight by 30 and round to the manuset integer.
 - -Assign this calculated value as the factor value.
- If these are no fisheries for portions of fisheries) within the target distance limit of the watershot, ensign a value of 0.

Enter the value assigned in Table 4-1.
4.1.3.3.2 Population: Evaluate the population factor for the evaluate the population factor for the evaluations, Level II concentrations, Level II concentrations, and potential human food chain continuouslates. Determine which factor applies for a fishery (or parties of a fishery) as specified in section 4.1.3.3.

4.1.3.2.2. Level francestrations.
Determine these fisheries (or portions of fisheries) within the watershed that are subject to Level I concentrations.

Estimate the human food chain population value for each fishery (or portion of a fishery) as follows:

Estimate human food chain production for the fishery based on the estimated annual

production (in pounds) of human food chain organisms (for example, lisk; shellfish) for that fishery, except: if the fishery is closed and a hazardous substance for which the fishery has been closed has been documented in an observed release to the lishery from a source of the site, use the estimated named production for the period prior to closure of the fishery or use the estimated annual production from comparable fisheries that are not closed.

Assign the fishery a value for human food chain population from Table 4-28, based on the estimated human food production for the fisher.

Set boundaries between fisheries at these peaks, where human feed chain production changes or where the surface water dilution weight changes.

Sum the human food chain population value for each fishery (and portion of a fishery). Multiply this sum by 16. If the product is less than 1, do not round it to the nearest integer, if 1 or more, round to the nearest integer. Assign the resulting value as the Level 1 concentrations factor value. Enter this value in Table 4-1.

4.13.2.2. Level II concentrations:

4.13.3.22 Level II concentrations.

Determine those Raberies (or portions of fisheries) within the wateraked that are subject to Level II concentrations. Do not include any fisheries (or portions of fisheries) already counted under the Level I concentrations factor.

Assign each fishery (or portion of a fishery) a value for human food chain population from Table 4-12, based on the estimated human food production for the fishery. Estimate the human food chain production for the fishery as specified in section 4.1.3.3.2.1.

Sum the human food chain population value for each lishery (and portion of a lishery). If this must is less than 1, do not round it to the mearest integer. As ign the round to the nearest integer. As ign the resulting value as the Level II concentrations factor value. Enter this value in Table 4-1.

TABLE 4-18.—HUMAN FOOD CHAIN
- POPULATION VALUES*

Human food chain production (pounds per, year)	Assigned human food chain population value
0	0
Greater than 0 to 160	0.03
Greater then 100 to 1,000	0.3
Greater then 1,000 to 10,000	3
Greater than 10,000 to 100,000	31
Greater than 100,000 to 1,000,000	310
Granter then 10° to 10°	3,100
Greater than 10° to 104	31,000
Greater than 10° to 10°	310,000
Greater then 10*	3,100,900

^{*} Do not round to nearest integer.

4.1.3.3.2.3 Potential human food chain contamination. Determine those fisheries (or portions of fisheries) within the watershed that are subject to potential human food chain contamination. Do not include those fisheries (or portion of fisheries) already counted under the Level I or Level II concentrations factors.

Calculate the value for the potential human food chain contaminat on factor (PP) for the watershed as follows:

$$PF = \frac{1}{10} \sum_{i=1}^{n} P_i D_i$$

where:

P.=Human food chain population value for - fishery i.

D_i=Dilution weight from Table 4-13 for fishery i.

fishery i.

2 = Number of fisheries subject to potential human food chain contamination.

in calculating PP:

"Estimate the human food chain
population value (P_i) for a fishery (or portion
of a fishery) as specified in section 4.1.3.3.2.1

of a fishery) as specified in section 4.1.2.2.1.

Assign the fishery (or portion of a fishery) a dilution weight as indicated in Table 4-13 (section 4.1.2.3.1), except do not assign a dilution weight of 0.5 for a "3-mile mixing zone in quiet flowing river"; instead assign a dilution weight based on the average annual flow.

If PF is less than 1, do not round it to the nearest integer, if PF is 1 or more, round to the nearest integer. Enter the value assigned in Table 4-1.

4.1.3.2.4 Calculation of population factor value. Sum the values for the Level I concentrations, Level II concentrations, and potential human food shain contamination factors for the watershed. Do not round this sum to the nearest integer. Assign it as the population factor value for the watershed. Enter this value in Table 4-2.

4.1.3.3.3. Calculation of human food chain threat-targets factor category value. Some the food chain individual and population factor values for the watershed. Do not round this sum to the nearest integer. Assign it as the human food chain threat-targets factor category value for the watershed. Enter this value in Table 4-1.

4.1.3.4 Calculation of human food chain threat score for a watershed. Multiply the human food chain threat factor takegory values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by \$2,500. Assign the resulting value, subject to a maximum of 100, as the human food chain threat score for the watershed. Enter this score in Table 4-1.

4.1.4 Environmental threat. Evaluate the environmental threat for the watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.4.1 Environmental threat-likelihood of release. Assign the same likelihood of release factor category value for the environmental threat for the watershed as would be assigned in section 4.1.2.1.3 for the drinking water threat. Enter this value in Table 4-1.

4.1.4.2 Environmental threat-waste characteristics. Evaluate the waste characteristics factor category for each watershed based on two factors: ecosystem toxicity/persistence/bioaccumulation and hazardous waste quantity.

4.1.4.2.1 Ecosystem toxicity/persistence/ bioaccumulation. Evaluate all those hazardous substances eligible to be evaluated for texticity/persistence in the drinking water threat for the watershed (see section 4.1.2.2).

4.1.4.2.1.1 Ecosystem toxicity. Assign an ecosystem toxicity factor value from Table 4-19 to each hazardous substance on the basis of the following data hierarchy:

• EPA chronic Ambient Water Quality Criterion (AWQC) for the substance.

 EPA chronic Ambient Aquatic Life Advisory Concentrations (AALAC) for the substance.

PPA acute AWQC for the substance.

. EPA acute AALAC for the substance.

Lowest LCos value for the substance.
 In assigning the ecosystem spicicity factor value to the hazardous substance:

 If either an EPA chronic AWQC or AALAC is available for the hazardous substance, use it to assign the acceptant toxicity factor value. Use the chronic AWQC in preference to the chronic AALAC when both are available.

 If neither is available, use the EPA-acute AWQC or AALAC to assign the ecosystem toxicity factor value. Use the acute AWQC in preference to the acute AALAC.

 If none of the cheonic and acute AWQCs end AALACs is available, use the lowest LCs reine to assign the ecosystem toxicity factor value.

 If an LCos value is also not available, assign an ecosystem toxicity factor value of 0 to the hazardous substance and use other hazardous substances for which data are available in evaluating the pathway.

If an ecosystem toicity factor value of 0 is assigned to all hazardous substances eligible to be avaluated for the watershed (that is, insufficient data are available for evaluating all the substances), use a default value of 100 as the acosystem toicity factor value for all these hazardous substances.

With regard to the AWQC AALAC or LCs selected for assigning the according to discount to discount to discount to the bazardous substance:

If values for the aelected AWQC.

AALAC, or LC₀ are available for both fresh
water and marine water for the hazardous
substance, use the value that corresponds to
the type of water body (that is, fresh water or
salt water) in which the sensitive
environments are located to assign the
ecosystem toxicity factor value to the
hazardous substance.

• If, however, some of the sensitive environments being evaluated are in fresh water and some are in salt water, or if any are in brackish water, use the value (fresh water or marine) that yields the higher factor value to sasign the ecosystem toxicity factor value to the hazardous substance.

• If a value for the selected AWQC.

AALAC, or LC₀₀ is available for either fresh water or marine water, but not for both, use the available one to assign an ecosystem toxicity factor value to the hazardous substance.

TABLE 4-18.—BOSINSTAM TOROTTY FROM I WILDES

If on ISA develo ASSOC or AALAC' is mobile, coolin it wise to follows:

Elinate AREC or ANAC	**
Less than 1 pg/L	1,000
Greater than 1979 199 pg/l	7

Paulibras VII. double AVIC on VII. double ANDS to anibite, andprix who board do the ANA mate ANISC of ANASC on Advance!

SPA easter ATTOC-er AFLAC	~
Less Ocio 100 pg/L	10,000
Greater State 1,000 to 10,000 pg/l Greater State 10,000 to 100,000 pg/l	

TABLE 4-19. ECOSYSTEM FORESTY FACTOR VALUES—Concluded

It selber as 'EPA chrests or scale AWGC nor EPA chrests or scale AALAC is smaleble, andgo a value from the LC_{III} as follows:

EPA acide AWOC or AALAC

v.	1
Late then 400 part	\$5 x x -

If many of the MANTES and ANLACS mer the LC., In probable, question to relate of C.

* ANICO-Ambied Water County Coloria.
* BALAC-Ambiest Aquelt: Life Advisory Concen-

"then the ANICC value in production to the ANIAC when both pre-model. See test for one of

4.14.2.1.2 Persistence. Assign a posistence factor value to each baseshoe substance as specified in section 4.12.2.1.2 except out the positionisms wester category (that is black or vivers, occurs, treated tital waters, or Great Laber) between the position point of easity and the except constitue coving that the except constitue coving that the except sensitive coving or constructs intuin along the baseshoes related to extend of the extended.

to determine which purties of Table 4-30 to use. Determine the productions water category based on distance as specified in section 41.2-21.2. For contaminated sediments with an identified swares, use the point where transcenses begins rather than the publishe point of eater.

43.4.24.3 Exception Sineconnelation potential. Assign un ecosystem biseccumulation potential factor value to each hazardous substance in the same names specified for the biseccumulation potential factor in the control of the biseccumulation potential factor in control of \$2.22.3.

menner specified for the bisepermelation potential factor in section 4.1.3.2.1.2, swept • Use SCF-date for all equate organizapot for aquatic busines food chain commons.

 Use the BCF data that corresponds to the type of water body (that it, finsh water or salt water) in which the samplive

4.1.4.2.1.4 Calculation of ecosystem texticity/ptexistences/liseccumulation factor value. Assign each, humedous substance in ecosystem textify/persistence factor value from Duble 4-40, bursel on the values, assigned to the humedous substance for the ecosystem textify and pusistence factors. Then easign each homesloss substance as ecosystem textify/persistence/
biseccumulation during value from Table 4-21, bursel on the unions substance and ecosystem biseccumulation substance and ecosystem biseccumulation potential factors. Salect the humedous substance with the highest ecosystem textify/persistence with the highest ecosystem factor value for the value and are it to assign the value in this factor. Buter this value in Table 4-2.

TABLE 4-28.—ECOSYSTEM TOXICITY/PERSISTENCE FACTOR VALUES*

Paralistance factor value	Engine takiy late uko					
	***	1,000	-	10 -	1	•
10 04 047 049	700 700 700 7	1300 400 70 97	7 2007	10 4 4.7 2007	0.007 0.007 0.0007	••••

[·] On which there is not to

TABLE 4-21
ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES®

Ecosystem Toxicity/ Persistence	E	cosystem Bio	accumulation	Potential :	Factor Value	•
Factor Value	50,000	5,000	500	50	.5	0.5
10,000	5 x 10 ⁸	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000
4,000	2 x 10 ⁸	2 x 10 ⁷	2 x · 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000
1,000	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500
700	3.5 x 10 ⁷	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350
400	2 x 10 ⁷	2 x 106 -	2 × 10 ⁵	2 x 10 ⁴	2,000	200
100	5 x 10°	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50
70	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35
40.	2 x 10°	2 x 10 ⁵	2 x 10 ⁴	2,000	200	20
10	5 x 10 ⁵	5 x 10 ⁴	5,900	500	50.	5
7	3.5 x 10 ⁵	.5. x 10 ⁴	3,500	350	35	3.5
4	2 x 10 ³	2 x 10 ⁴	2,000	200	20	. 2
1	5 x 10 ⁴	5,000	500	50		0.5
0.7	3.5 x 10 ⁴	3,500	350	35	3.5	0.35
0.4	2 x 10 ⁴	2,000	200	20	. 2	0.2
.0-07	3,500	350	35	3.5	0.35	0.035
0.007	350	35	3.5	0.3	5 0.035	0.0035
0.0007	35	3.5	0.3	5 0.0	35 (01003)	5 0.00035
0	0	0	. 0	0	0	0

^{*}Do not round to nearest integer.

4.1.4.2.2 Himmeleus waste quentity.
Assign the same factor value for hettreleus waste quentity for the watershed as would be assigned in section 4.1.2.2.2 for the drinking water thans. Inter this value in Table 4-1.
4.1.4.2.3 Colculation of assistance and these course characteristics factor cottagety value. For the houseless substance relacted for the for tached in section 4.1.4.2.1.4, us its constant to the factor factor water.

for the off memory and appears to be and one of the control of the the waste characteristics factor entegry.
First, sublight the ecosystem texticity/
jumintance factor value and the humidous
visate quantity listiff value for the
vestesshiel, subject to a meximum product of
3x197. Then sublight this product by the
ecosystem bisecommission potential factor
value for this hescelous substance, subject to

Cancentration corresponding to EPA
Ambient Aquetic Life Advisory
Cancentration (AALAC).

a executary product of 13/30th Shool on this avoused product, so ...go a value four Table 2-7 (section 24.3.1) to the covinsumental threat-water characteristics factor category for the watershot. Enter this value in Table 4-1.

TABLE 4-22—ECOLUDICAL-BRIED BENCHMARKS FOR THAZAMBOUS SUBSTANCES IN SUBFRICE WATER

- Ambient Water Quality Criteria (AWQC) for

Select the appropriate AWQC and AALAC as follows:

- -Use chamic value, if available: otherwise use acrite value.
- -If the sensitive card evaluated is in finely woter, use linely water value, except: if no frush senter value is available, use marine value if available.
- -If the sensitive continuous theing creditated in in soft water, use marine value, except: If no marine value is crealable, use thath water value if available.
- -If the sensitive environment being evaluated in its both fresh water and sult water, or in in benckish water, use lower of fresh water or marine values.

- TABLE 4-23.—SENSITIVE ENVIRONMENTS RATING VALUES

Sensitive environment	Assigned value
Callege habbet * for Federal designated enforqueut or Directored species	100
Designated Federal Wildements Area Lease Martillad under Created Zeine Management Act * Innatifies areas: Mortillad under Matienal Estimay Program * or Most Chaptel Waters Program * Sullad areas: Martillad under the Cities Labor Program *	
taland Majorant ^a Inford Stan ² an Teoretinal Ann Inford Estanbor-Recrisional Ann	
Milighthouns to be used by Federal designated or proposed orderspand or directored species	75
int of Countil Burder Recourtes System bastist Burder (professional) underet Burder (professional) underet Burder (professional architectural accomptions this behalt burder (professional Burderet) this behalt burder (professional Burderet)	
panning areas called * for the maintenance of flah/shallish species within mor, labe, or coastal tall values Synthety pathways and flooding trees called for maintenance of anadromous feh species within mor necture or areas in lates or coastal tall waters in which the fath spend extended periods of tree corrected even officed for breading by large or dunce aggregations of arimsts * failental duter much designated an flactoristical	
habitet beginn to be used by State designated ordersgand or desiliented species. Middlet beginn to be used by species under review as to its Federal ordersgared or desiliented states Joseph Bastler (portially developed) Tederal designated Scenic or WAI Florer	(S)
Taxin jurid designated for while or game management. Taxin designated Stock or VMA Filter Taxin designated Stock or VMA Filter Taxin designated Material Areas Taxing designated Material Areas Taxing of the stock of the st	25
hate designated amostler protection or mountainance of aquetic file '	5

*College Instructions Seefined in Sto CFR 454.82.

*Press identified in Stoto Coastel Zore Management plans as requiring presection because of ecological value.

*Medienal Behatry Program shorty arms (subsects additional additional in Comprehensive Consumption and Management Plans as requiring protection across they require collected life steppes of large subsection 320 of Clean Water Act, as amended.

**Allow Coastel Waters as defined in Sections 1968(5), 304(1), 379, and 320 of Clean Water Act, as amended.

**Clean Later Program collect areas (trubures within later, or a some cases enter aread later) as amended,

**Clean Later Program collect areas (trubures within later, or a some cases enter aread later) developed by State Clean Later Plans as collect hebitat (Section of Clean Water Act, as amended,

**Uses only for all entered described as being used for interes or concentrated spanning by a given spaces.

**For the air engenties pathway, first to temperal variables spaces. For the surface water register pathway, first to temperal variability or interested variability and the section 305(as of Clean Water Act, as arvended).

**Annage description and the Section 305(as of Clean Water Act, as arvended).

TABLE 4-24.—WETLANDS FLATING VALUES FOR SURFACE WATER MIGRATION PATH-

cital length of wellands * (miles):	Assigned value
Less than 0.1	
Greater than 1 to 2. Greater than 2 to 3.	2
Greater than 3 to 4	100
Greater than 816 12 Greater than 12 to 16	250 350
Greater then 16 to 20	460 500

"Wellands as defined by 48 CFR-Section 230.3.

4.1.4.3 Environmental threat-targets. Evaluate the environmental threat-targets factor category for a watershed using one itive environments.

4.1.4.3.3 Sensitive environments. Evaluate multive environments along the bazardous substance migration path for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential conta

Determine which factor applies to each sensitive environment as specified in section 4.1.2.3, except: use ecological-based benchmarks (Table 4-22) rather than benthbased benchmarks (Table 3-10) in determining the level of contamina samples. In determining the level of actual contemination, use a point of direct observation anywhere within the sensitive environment or samples (that is, surface water, benthic, or sediment samples) takes anywhere within or beyond the amultive environment (or anywhere adjacent to or beyond the sensitive environment if it is configures to the migration path):
41:43-1.1 Level I concentrations. Assign

value(s) from Table 4-23 to each sensitive environment subject to Level I concentrations.

For those sensitive environments that are wetlands, assist an additional value from Table 4-24. In assigning a value from Table 4-24, include only those portions of wetland located along the hazardous substance migration path in the area of Lavel I s of wetland concentrations. If a wetland is located partially along the area of Level ! concentrations and partially along the area of Level II concentrations and for potential contumination, then solely for purposes of Table 4-24, count the portion(s) along the areas of Level II concentrations or potential contumination under the Level II concentrations factor (section 4.1.4.3.1.2) or potential contamination factor (section 4.1.4.3.1.3), as appropriate.

Estimate the total length of wetlands along the hazardous substance migration path (that is, wetland frontage) in the area of Level I concentrations and assign a value from Table 4-24 based on this total length. Estimate this length as follows:

 For an isolated wetland or for a wetland where the probable point of entry to surface water is in the wetland, use the perimeter of that portion of the wetland subject to Level I concentrations as the length.

. For rivers, use the length of the wetlands contiguous to the in-water segment of the hazardous substance migration path (that is, wetland frontage).

· For lakes, oceans, coastal tidal waters, and Great Lakes, use the length of the wetlands along the shoreline within the target distance limit (that is, wetland frontage along

the shoreline].

Calculate the Level I concentrations factor value (SH) for the watershed as follows:

WHI-Value assigned from Table 4-3t to wetlends along the area of Level I concentrations.

S₁ = Value(s) sesigned from Table 4-23 to sessitive environment i. n = Number of sensitive environments fro

Table 4-23 subject to Level 1

Enter the value assigned in Table 4-1. 4.1.4.3-1.2 Level II concentrations. Assign value(s) from Table 4-23 to each sensitive environment subject to Level I concentrations. Do not include s environments already counted for Table 4-23 ander the Level I concentrations factor for this watershed.

For those sensitive environments that are rer mose season a extrement that are wetlands, assign an additional value from Table 4-24. In assigning a value from Table 4-24, include only those portions of wetlands located along the hexardous substance migration path in the area of Level II concentrations, as specified in section 414311

Estimate the total length of wetlands alor the hazardous substance migration path (that is, wetland frontage) in the area of Level II concentrations and assign a value from Table 4-24 based on this total length: Estimate this length as specified in section 4.1-4.3.1.1, except: for an isolated wetland or for a welland where the probable point of entry to surface water is in the wetland, use the perimeter of that partian of the wetland subject to Level II (not Level I). concentrations as the length.

Calculate the Kevel II concentrations value (SL) for the watershed as follows:

$$SL=WL+\sum_{i=1}^{n} S_{i}$$

WL=Value assigned from Table 4-24 to wetlands along the area of Level II concentrations.

S,=Value(s) assigned from Table 4-23 to sensitive environment i.

n=Number of sensitive environments from Table 4-23 subject to Level II concentrations.

Enter the value assigned in Table 4-1. 4.1.4.3.1.3 Potential contamination. Assign value(s) from Table 4-23 to each sensitive environment subject to potential

contamination. Do not include sensitive environments already counted for Table 4-23 under the Level I or Level II concentrations factors.

For each type of surface water body in Table 4-13 (section 4.1.2.3.1), sum the value(s) assigned from Table 4-23 to the sensitive environments along that type of surface water body, except: do not use the surface water body type "3-mile mixing some in quiet flowing river." If a somitive environment is nowing river." It is sensitive environment is along two or more types of surface water bodies (for example, Wildlife Rufings contiguous to both a moderate stream and a large river), assign the sensitive environment only to that surface water body type having the highest dilution weight value from Table

For those sensitive environments that are retlands, assign an additional value from Table 4-34. In assigning a value from Table 4-34, include only those portions of wetlands located along the lazardous substance migration path in the area of potential contamination, so specified in section
4.1.4.3.1.1. Aggregate these wetlands by type
of surface water body, except do not use the
surface water body type "3-mile mixing zone
in suite flowing time." These the wetlands in quiet flowing river." Treat the wetlands aggregated within each type of surface wa a each type of surface water aggregated within each type or surrows re-body as separate sensitive savinguments solely for purposes of applying Table 4-24. Estimate the botal length of the wetlands within each surface water body type as specified in section 4.1.4.1.1.1, exce isolated wetland or for a wetland where the isolated wettant or for a wettand where the probable point of entry to surface water in in the wetland, use the perimeter of that portion of the wetland subject to petential contamination for the portion of that perimeter that is within the target distance limit) as the length. Assign a separate value from Table 4-94 for each type of surface water body in the watershad.

Calculate the potential contemination factor value (SP) for the watershed as

follows:

where:

Su=Value(s) assigned from Table 4-23 to sensitive environment i in surface water body type j.

Number of sensitive environments from Table 4-23 subject to potential contamination.

W;= Value assigned from Table 4-24 for wetlands along the area of potential contamination in surface water body type i.

D,=Dilution weight from Table 4-13 for surface water body type j.

m=Number of different surface water body types from Table 4-13 in the watershed.

If SP is less than 1, do not round it to the nearest integer, if SP is 1 or more, round to the nearest integer. Enter this value for the potential contamination factor in Table 4-1. 41.4.2.1.4 Cilculation of conferences of threat-largests factor cate yeary reals. Sum the values for the Level II concentrations. Level II concentrations, card paymental contention tion concentrations, and pajoratel contemination factors for the watershed. Do not round this rum to the nament integer. Assign this own on the namental theori-tagate factor category value for the watershed. Enter this

ther in Table 4-a.

\$1.4.4 Calculation of continuous and contention Multiply the nat score for a water formation though referencested theset factor category values r Molihood of solonos, waste matheod of relates, waste matheod of relates, waste matheod of relates, waste for the watershold insued the product to the assess integer. In altitle by M.Dill. Antign the modification, majority to a mathematical M. or finite impact of M. or finite magnification of M. or finite magnification of M.

velot, temporary continues to the temporary continues in Table 4-1.

4.15 Collection of overheal/fixed migration component acress for a vestexhed. Sum the sames for the three tipsets for the vestexhed (that is, delating vestex, immediately continues to the temporary continues to the tempora eign te m g man, subject to a Alloga, and sentency serves, security to a microleum value of \$10, as the surface water overhead/lead adjustes entryment source for the watershed. Enter this score in Toble

- 4.1.6 Calculation of ornaland/floor algorithm companies of score. Beloot the ighout machine water ornaland/floor algorithm companies onto from the migration compount come from the vertexhalo conducted. Analyze this some on the culture syntax conducted third migration compount access for the other colors to a maximum occurs of 160. Noter this occur in Table 4-L
- Table 4-1.

 4.2 Grand water to surface rooter adjustion component. Use the grand water to refer the grand water to confine water surface water adjustion component to evaluate surface water those adjustion of humaters addust via grand water. Declarate these types of thresh for this component detailing water threat. Insure food chain threat, and coversemental threat.
- 421 General considerations.
 423.1 Eligible surface system. Calculate sends water migration suspensed source only for surface waters see section 482) for which all the following ---
- A portion of the recince water is within 1 mile of one or more sources at the site having and factor value greate: than I (see ection 42217)

- No equiles discontinuity is established between the source and the portion of the surface water within 1 mile of the source (see ction 3.0.1.2.2). However, if hazardous between have migrated across an appe scentimity within this 1 mile distance. not consider a discontinuity present in scoting the pite.
- The top of the upperment aquifer is at or above the bottom of the surface vector.

Do not evaluate this component for situs maintage anishs of conteminated sediments consisting solely of contest with no identified source.

- 4212 Definition of honorclose substant igration path for ground water to surface uter minutes consequent. The hotselves n component. The hexadens when path includes both the switer migration compression and substance substance substance substances and the surface vester in-water segment that hazardous substances would take as they migrate away from 200 et <u>fin</u> elle:
- * Testical the ground water segment to migration via the upperment squifer between a source and the nucleon water.
- migration via the appropriate against between and the surface venter.

 Bugin the surface water in-venter anguest the probable paint of entry from the approximate against to the surface water. Identify the probable point of entry as the paint of the excitor water that yields the shortest studgle-line distance, within the shortest studgle-line distance. Within the sentity humadary free section 3.0.1.2. for that studyed has distance, within the fire boundary (see section 3.8.1.2), from sources at the also with a containment factor value greater than 0 to the surface
 - stone, continue the in-water great in the direction of flow scholing any tidal flowe) for the stones established by the target

distance executions 4.2.1.4).

-For labor, economic control tidal waters, or Great Labor, do not consider flow direction. Instead apply the terget

-If the in-water expenses includes he stress and labor (or occase, conpest includes both recessor, courted stress and lakes (or occurs, commented that waters, or Great Lakes), apply the turget distance limit to their con in-water sag

Consider a site to be in two or more vetershede for this compensest if two or more hannedous substance migration poths from the sources at the alte do not reach a common at within the target distance limit. If the offer in more than one watershed, define a repeate hazardous substance migration path for each wetershed. Evaluate the ground ter to surface water migration component

for each watershed separately as specified in m 4215

4.2.1.3 Observoi release of a specific considers embetance to surface water inent Section 42211 specifies the criteria for antiguing values to the observed release factor for the ground water to surface All in components sent. With regard to substance, consider water migration companies. With regard to an individual homology substance, comide an observed taleace of that hamalous substance to be established for the systace ventor in water segment of the ground water to surface water migration compensat only when the homology substance made the critoris both for an observed solves both to ground water (see section 42.21.1) and for an observed solves by chamical analysis to surface water (see section 41.2.1.1).
If the houseless substance mosts the

or we measures cabeleace mosts the section 43.2.1.1 culture for an observed release by chamical analysis to surface water but does not also meet the calteris for an observed release to pound water, do not use any samples of that beautifus enhotance from the surface water in water segment in mahating the first of the section of the evaluating the factors of this compensor example, do not use the beautions sub-in establishing tempts subject to actual in establishing tempts subject to actual controllers or in determining the level of actual controllers for a beauti

communities or in communing we rever or actual contemination for a tageth. 4.2.1.4 Taget distance limit. Determine the taget distance limit for each watershed as specified in section 4.1.1.2, except; do not as specified in section 4.1.12, except; sponse extend the target distance limit to a sample location beyond 15 miles unless at least one hearsdoor substance in a sample from that incention mosts the criticis in section 4.2.1.3 r an observed pulsase to the surface water

territor the trapets eligible to be set of the trapets eligible to be set of for each watershed and establish an arrest one subject to actual o e tragets are enhighed to actual or demination or specified in section 4.1.1.2, enough do not establish actual contemination based on a sample location unities at least one hazardous substance in a valies at least one hearthes substance in a sample from that location meets the criteria in section 4.2.1.3 for an observed release to

the surface water in water segment.

4.2.15 - Brukestier of ground water to
surface water migration component. Brekets
the delekting water threat, human find chain
threat, and mattermental threat for each westershed for this compensat heard on three factor compensat heard on three factor compensat Helikaed of seleces, waste characteristics, and impos. Figure 4-2-indicates the factor included within each factor category for each type of diseat.

COLUMN COMMON COLUMN CO

Waste Characteristics (MC) Texticity/Mobility/Persistence: · foxicity Population ... Larenic **Level I Concentration: * . Local . 11 Concentrations Concinopenic Acute. Mobility - With solubility - Distribution Coefficient ((2) - Metf-life Angerdous Unete States Tty. • Mazordius Const Duent, Guent Sty-. Hezardous Vastestreem Guantity • Volume . Ares Number Food Chain Waste Characteristics (MC) Targets (1) Toxicity/Mobility/Persistence/ Bioaccumulation • Toxicity Food Chain Individual Population -«. Level & Contientrations - Chronic men food Cliain - Caccinogénic ¥ -Prediction - :-. Level-11-Barkentrations - Acute .. ~ Homen Food Chain-Mobilier - Meter Solubility Preduction : Distribution Coefficient (Kg) otereiel Human Food. Chain. Contamination • Persistence. - Hat felife - hanny food thein Production . Bioecountletien Perential Mazandous Haste Quantity Mazardous Constituent Quantity • Nazardous Wastestream Quantity: . Environmental To Section 2 1 of Targets"(T) Waste Characteristics (MC) Sensitive Environments Ecosystem Toxicity/Mobility/ Persistence/Bioaccumulation · Level I Concentrations Ecosystem Foxicity, - Ambient Mater Gustity Kent fall Chinten Inetion ··· Criteria - Imbient Aquetic Life Advisory Concentrations Mobility · Water Solubility · Distribution Coefficient (Kg) Persistence. - Holf-tife • Ecosystem Bioaccumulation ·Potential ·

Figure 4-2 UVERVIEW OF GROUND WATER TO SURFACE WATER MEGRATEON COMPONENT

Hazardous Weste Guinties - Hazardous Sestestries Guentity - Hazardous Constitutent Guentity

• Volume

Observed Release or Potential to Aplease

• Containment • Net Precipitation

• Travel Jime

. Depth to Aquifer .

ignation component score [5,2] for a all in terms of the factor category shoe se fellows:

- UR, willhalthood of "slease factor category value for flow. (that is, dejubling swater, luman food chain, or covironmental

- Table 4-25 entines the specific calculation generature.
- If the alte is in only one watershed, and give ground water to emilion water adjusted outpeaked as the

- or extra versions...

 Salect the highest ground-verter to extince water adjustion temperant store from the waterlands ovelasted and energy it as the ground water to summer wave, minuting component score for the alte. d water to surface water

TABLE 4-25.--GROUND WATER TO SUFFACE WATER MIGRATION COMPONENT SCOPENHEET

Factor categories and factors	Mariana Vales	Yake striped
Britishing Water Threat		
helband of Bulana to Andillas	1 1	
1. Charred Relatio	969	_
2. Potential to Patricus: ~	- 1. 1	•
à Contract		-
3h. Not Poulphalen	**	
Z. Crys v Agilir		
21. Tani Tina	35	
Sa. Princial to Referenţines SaCS+Ro+20	😎	
2. Linding of Ration (Alford State 1 and 21	559	-
uto Chanadadhar 4 Today Malify Pauldanto	1 1	
	📜 i	. ——
S. Hannibus Whatis Quartly		
ryste: 7. Narres bable	se i	
2. Public		
St. Leaf Constraints		
St. Lord & Contestations	= 5	\equiv
& Name Construction		
St. Paradiar Shar Sq. + Sb. + St		
A Comment of the Comm	s	==
16. Togoto (Bres 7 + 64 + 5)		
Miles Water Reseat Searce		
11, Dalating Wager Throat Score (Elens 3 x 6 x 108/02/00), subject to a maximum of 1000		:
Numan Food Chain Threat	1 1	
afficed of finitese:	1 1	
12. Utalbasi di Ratesso (sono volue se fino \$		•
And the second state of th		,
13 Tools (Matthe Production of Research Asian	🖚	
14 Pagestas West Coasts		
15. Waste Characteristics		
-		
16. Fred Chair Individual	🖘 🛚	
17. Population		
17s. Lord I Concentrations		
17b. Land T Concentrations	= 2	
17s. Potential Human Food Chain Contemination	N	
17d. Psycholog (Inco 17a + 17b + 17c)		
18 Tagets (Lines 16 + 174)	M	
	: 1	
	. ! i	
man Food Chain Threat Searc: 18. Human Food Chain Threat Score (Chas. 12 x 15 x 161/92,590, subject to a creatment of 169)	100	
	100	 .
19. Human Food Chain Threat Score (Cines 12 x 15 x 163/62.50), subject to a maximum of 169) Embrumental Threat officeed of Reference:	100	 .
19. Human Food Chain Threat Score (Cines 12 x 15 x 163/52,360, subject to a maximum of 169)		
19. Human Foot Chain Threat Score (Chain 12 x 15 x 163/92.300, subject to a maximum of 109) Embrummental Threat Silvanian of Release (some value as fine 3) 30. Likelinated of Release (some value as fine 3) 30. Characteristics	550	
19. Human Food Chain Threat Score (Cines 12 x 15 x 16)/42.360, subject to a maximum of 169) Embrumental Threat although of Release 30. Likelihood of Release (game value as fine 3)		
19. Human Foot Chain Threat Score (Chas. 12 x 15 x 163/52.50), subject to a maximum of 169) Embrumental Threat 28. Unificated of Release (some value as the 3)	550	
19. Hunten Foot Chain Threat Score (Cines 12 x 15 x 163/92.50), subject to a receivem of 109) Embrumental Threat allowed of Release (some value as line 3) also Characteristics: 21. Exception Testaby-Media/Provisionos/Seconduction. 22. Hundrest Watto Characteristics. 23. Window Characteristics.	590 (a)	
19. Human Foot Chain Threat Score (Chain 12 x 15 x 163/192.510), subject to a maximum of 109) Embrumental Threat Shaded of Release: 31. Likelihood of Palacese (spine value as fine 3) ste Characteristics: 21. Empruson Tericity/Modiffy/Posistence/Resconstation. 22. Humanis Waste Characteristics 23. Weste Characteristics 24. Weste Characteristics	550 	— · — — — — — — — — — — — — — — — — — —
19. Henten Foot Chain Threat Score (Chas 12 x 15 x 163/10.340, subject to a maximum of 169) Embremental Threat although of Release 21. Limited of Release (spine value as the 3) and Chandel of Release (spine value as the 3) 22. Hamming Wate Chandly 23. Waste Chandel Wate Chandly 24. Supplier Chanceless 26. Supplier Chanceless 27. Supplier Chanceless	550 	·
19. Henten Foot Chain Threat Score (Cines 12 x 15 x 163/92.50), subject to a receivement of 109) Embrumental Threat although of Release (some value as line 3) alto Chanateristics: 21. Empress Testaly-Matthy/Perintence/Responsibilities 22. Hazarten Watte Chanally 23. What Chanateristics 1948: 24. Sendire Emissionness: 29. Level of Chrossophysis 29. Level of Chrossophysis 29. Level of Chrossophysis	5500 (a) 1 (b) 1,5000	
19. Henten Foot Chain Threat Score (Chain 12 x 15 x 163/102.510), subject to a minimum of 100) Embrummental Threat Sill Likeling of Philosope (spine value as fine 3) sto Characteristics 21 Empress Tericity/Mat/My/Perintence/Resources/soc. 22. Waster Waste Characteristics 23. Waste Characteristics 24. Street Characteristics 26. Lent I Characteristics 29. Lent I Characteristics 29. Lent I Characteristics	550 (a) (b) (1,000	
19. Henten Foot Chain Threat Score (Cines 12 x 15 x 163/92.50), subject to a receivement of 109) Embrumental Threat although of Release (some value as line 3) alto Chanateristics: 21. Empress Testaly-Matthy/Perintence/Responsibilities 22. Hazarten Watte Chanally 23. What Chanateristics 1948: 24. Sendire Emissionness: 29. Level of Chrossophysis 29. Level of Chrossophysis 29. Level of Chrossophysis	5500 (a) 1 (b) 1,5000	

TABLE 4-25,--GRIQUIND WATER TO SURFACE WATER MIGRATION COMPONENT SCORESHEET--CONTINUED

Factor categories and factors	Missimum Value	/alue assigned
Environmental Threat Score: 26. Environmental Threat Score ((lines 20 x 23 x 251/62,500, subject to a maximum of 60) Ground Water to Surface Water Migration Component Score for a Watershed	6 0	
27. Wetershed Score (fines 11 + 19 + 26, subject to a maximum of 100)	100 100	

^{*}Materium value applies to waste characteristics category.

4.2.2 Drinking water threat. Evaluate the drinking water threat for each watershed

based on three factor categories: likelihood of release, waste characteristics, and targets. 4.2.1. Drinking water-threat-likelihood of release. Evaluate the likelihood of release factor category for each watershed in terms of an observed release factor or a potential to

release factor.

A.2.2.1.1 Observed release. Establish an observed release to the uppermost aquifer as specified in section 3.1.1. If an observed release can be established for the uppermost aquifer, assign an observed release factor value of 550 to that watershed, enter this value in Table 4-25, and proceed to section 4.2.2.1.5. If no observed release can be established, assign an observed release factor value of 0, enter this value in Table 4-25, and proceed to section 4.2.2.1.2.

4.22.1.2 Potential to release: Evaluate potential to release cannot be established for the appearance aquifer: Calculate a potential to release varies for the uppermost aquifer as specified in section 3.1.2 and sections 3.1.2.1 through 3.1.2.5. Assign the potential to release value for the uppermost aquifer as the potential to release factor value for the watershed. Enter this value in Table 4-25.

4.2.2.1.3 Calculation of drinking-water threat-likelihood of release factor category value. If an observed release is established for the uppermost aquifer, assign the observed release factor value of 550 as the likelihood of release factor category value for the watershed. Otherwise, assign the

potential to release factor value as the likelihood of release factor category value for the watershed. Enter the value assigned in Table 4-25.

4.2.2. Drinking water threat-waste characteristics. Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/mobility/persistence and hezardous waste quantity. Evaluate only those hazardous substances available to migrate from the sources at the site to the uppermost aquifer (see section-3.2). Such hazardous substances include:

 Hazardous substances that meet the criteria for an observed release to ground writer.

• All hazardom substances associated with a source that has a ground water containment factor value greater than 0 (see sections 2.2.2, 2.2.3, and 3.1.2.1).

42221 Tracicity/mobility/persistence. For each hazardous substance, assign a toxicity factor value, a mobility factor value, a persistence factor value, and a combined toxicity/mobility/persistence factor value as specified in sections 4.2.2.2.1.1 through 4.2.2.2.14.

4.2.2.2.1.1 Toxicity. Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.2.2.1.2 Mobility. Assign a ground water mobility factor value to each hazardous substance as specified in section 3.2.1.2.

422213 Persistence. Assign a surface water persistence factor value to each

hazardous substance as specified in section 412212

4.2.2.3.1.4 Calculation of toxicity/
mobility/persistence factor value. First,
assign each lazardous substance a toxicity/
mobility factor value from Table 3-0 (section
3.2.1.3), based on the values essigned to the
hazardous substance for the toxicity and
mobility factors. Then essign each bazardous
substance a toxicity/mobility/persistence.
factor value from Table 4-20, based on the
values essigned for the toxicity/mobility and
persistence factors. Use the substance with
the highest toxicity/mobility/persistence
factor value for the watershed to assign the
value to this factor. Enter this value in Table
4-25:

4.2.2.2 Honordons woste quantity.

Assign the same factor value for hazardous waste quantity for the watershed as would be assigned for the uppermost aquifer in section 3.2.2 Buter this value in Table 4-25.

4.2.2.3 Calculation of drinking water threat-waste characteristics factor category value. Multiply the toolcity/mobility/persistence and hazardons waste quantity factor values for the watershed, subject to a maximum product of 1×10°. Based on this product, assign a value from Table 3-7 (section 2.4.3.1) to the drinking water threatwaste characteristics factor category for the watershed. Enter this value in Table 4-25.

4.2.2.3 Drinking water threat-targets.

Evaluate the targets factor category for each
watershed based on three factors: nearest
intake, population, and resources.

BRADES COSE 6888-68-18

Meximum value not applicable.

TABLE 4-26
TOBICITY/HOBILITY/PERSISTENCE FACTOR VALUES®

	Persistence Factor Value				
Toxicity/Mobility Factor Value	1.0	0.5	0.07	0.9097	
10_000	10,900	4,000	700	7	
2,000	2,000	800	140	1.4	
1,000	1,090	400	70	0.7	
200	200	30	14	0.14	
300	190	40	7	0.07	
20	25	•	1.4	9.014	
20	19	4	9.7	9.007	
2	2	9.8	0.14	0.0016	
1	1	0.4	9.67	7 x 30 ⁻⁴	
0.2	0.2	0.08	0.014	1.4 x 10 ⁻⁴	
●.1	0.1	0.04	0.807	7 x 30 ⁻⁵	
0.02	0.02	0.D06	0. 89 14	1.4 x 10 ⁻⁵	
9.62	8.81	9.004	7 x 10 ⁻⁴	7 x 39-6	
0.002	9.002	8 x 10 ⁻⁴	1.4 x 10 ⁻⁴	1.4 x 19 ⁻⁶	
9.001	0.001	4 x 10 ⁻⁴	7 x 18 ⁻⁵	7 x 10 ⁻⁷	
2 × 30 ⁻⁴	2 x 10 ⁻⁴	8 x 10-5	1.4 x 16 ⁻⁵	1.4 x 10-7	
1 × 10 ⁻⁴	1 x 10 ⁻⁴	4 x 19 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁸	
2 x 10 ⁻⁵	2 x 10 ⁻⁵	8 x 10 ⁻⁶	1.4 x 10 ⁻⁶	1.4 x 10 ⁻⁸	
2 × 10 ⁻⁶	2 x 10 ⁻⁶	8 x 10 ⁻⁷	1.4 x 10 ⁻⁷	1.4 x 10 ⁻⁹	
2 x 10 ⁻⁷	2 x 10 ⁻⁷	8 x 10 ⁻⁸	1.4 x 10 ⁻⁸	1.4 x 10-10	
2 x 10 ⁻⁸ ·	2 × 10 ⁻⁸	8 x 10 ⁻⁹	1.4 x 10 ⁻⁹	1.4 x 10 11	
2 x 10 ⁻⁹	2 x 10 ⁻⁹	8 x 10 ⁻¹⁰	1.4 x 10 ⁻¹⁰	1.4 x 10 ⁻¹²	
o · .	0	0	0	0	

^{*}Do not round to nearest integer.

For the nearest intake and population factors, determine whether the target surface water intakes are subject to actual or potential contamination as specified in section 4.1.1.2, subject to the restrictions specified in sections 6.2.1.3 and 4.2.1.4.

When the intake is subject to actual

When the intake is subject to actual contamination: evaluate it using Level I concentrations or Level II concentrations. Determine which level applies for the intake by companing the exposure concentrations from a sample (or comparable samples) to health-based benchmarks as specified in section 4.1.2.3, except use only those samples from the surface water in-water segment and only those hazardous substances in sections 4.2.1.3 and 4.2.1.4.

4.2.2.3.1 Nearest intake. Assign a value to the nearest intake factor as specified in section 4.1.2.3.1 with the following modification. For the intake being evaluated.

multiply its dilution weight from Table 4-13 (section 4.1.2.3.1) by a value selected from Table 4-27. Use the resulting product not the value from Table 4-13, as the dilution weight for the intake for the ground water to surface water component. Do not round this product to the nearest integer.

Select the value from Table 4-27 based on the angle Q, the angle defined by the sources at the site and either the two points at the intersection of the surface water body and the 1-mile distance ring of any two other points of the surface water body within the 1-mile distance ring, whichever results in the largest angle. (See Figure 4-3 for an example of how to determine Q.) If the surface water body does not extend to the 1-mile ring at one or both ends, define Q using the surface water endpoint(s) within the 1-mile ring or any two other points of the surface water body within the 1-mile distance ring. whicher at results in the largest angle.

TABLE 4-27.—DILUTION WEIGHT ADJUSTMENTS

Angle Θ (degrees)	As- signed value
Greater than 0 to 18 Greater than 16 to 54 Greater than 16 to 54 Greater than 54 to 90 Greater than 90 to 128 Greater than 126 to 162 Greater than 126 to 188 Greater than 126 to 188 Greater than 126 to 204 Greater than 270 to 205 Greater than 270 to 205 Greater than 305 to 342	0 0.05 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

^{*} Do not round to meanest integer.

BILLING CODE 9500-50-16

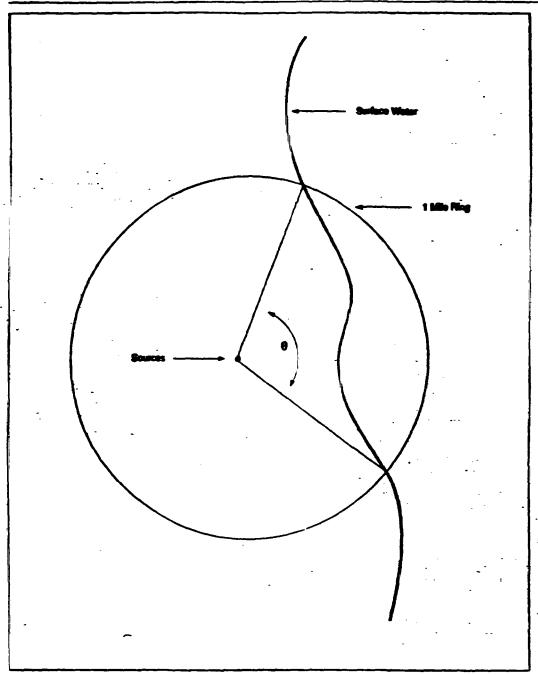


FIGURE 43
SAMPLE DETERMINATION OF GROUND WATER
TO SURFACE WATER ANGLE

TABLE 4-28
COXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES®

Toxicity/ Hobility/ Persistence Factor Value	Bioaccumulation Potential Factor Value							
	50,000	5,000	500	50	5	0.5		
10,000	5 x 10 ⁸	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000		
4,000	2 x 10 ⁸	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000		
2,000	1 x 10 ⁸	1 x 10 ⁷	1 x 10 ⁶	1 x 10 ⁵	1 x 10 ⁴	1,000		
1,000	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500		
800	4 x 10 ⁷	4 x 10 ⁶	4 x 10 ⁵	4 x 10 ⁴	4.000	400		
700	3.5 x 10 ⁷	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	. 350		
400	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	200		
200	1 x 10 ⁷	1 x 10 ⁶	. 1 x 10 ⁵	1 × 10 ⁴	1,000	100		
140	7 x 10 ⁶	7 x 10 ⁵	7 x 10 ⁴	7,000	700	. 70		
100	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50		
80	4 x 10 ⁶	4 x 10 ⁵	4 x 10 ⁴	4,000	400	40		
70	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35		
40	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	200	20		
20	1 x 10 ⁶	1 x 10 ⁵	1 x 10 ⁴	1,000	100	10		
14	7 x 10 ⁵	7 x 10 ⁴	7,000	700	70	7		
10	5 x 10 ⁵	5 x 10 ⁴	5,000	500	, 50	5		
8	4 x 10 ⁵	4 x 19 ⁴	4,000	400	40	4		
7	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35	3.5		
. 4	2 x 10 ⁵	2 x 10 ⁴	2,000	200	20	2		
2	1 x 10 ⁵	1 x 10 ⁴	1,000	100	10	1		
1.4	7 x 10 ⁴	7,000	7 0 0	70	7	0.7		

TABLE 4-28 (Continued)

Toxicity/ Hobility/ Persistence Factor Value		os Value	lue			
	50,000	5,000.	500	50	5	Ö.5
1.0	5 x 10 ⁴	5,000	500	SÓ	5. T.	0.5
0.8	4 x 10 ⁴	4,000	400	40	4	0
0.7	3.5 x 10 ⁴	3,500	350	35	3.5	C.35
0.4	2 x 10 ⁴	2,000	200	20	2	0.2
0.2	1 x 10 ⁴	1,000	100	10	1 ·	0.1
0.14	7,000	700	70	7	0.7	0.07
0.1.	5,000	500	50	5	0.5	0.05
0.06	4,000	400	40	4	0.4	0.04
0.07	3,500	350	35	3 5	0.35	0.035
0.04	2,000	200	20	2	0.2	0.02
0.02	1,000	100	10	1	•	0.01
0.014	700	70	7	0.7	0.07	0.007
0.01	500	50	5	0.5	0.05	0.005
0.008	400	40	4	0.4	0.04	0.004
0.007	35 0	35	3.5	0.35	0.035	0.0035
0.004	200	20	2	0.2	0.02 -	0.002
0.002	100	10	1	0.1	0.01	0 1
0.0014	70	7	0.7	0.07	0.007	7 x 10 ⁻⁴
0.001	50	5.	0.5	0.05	0.005	5 x 10 ⁻⁴
8 x 10 ⁻⁴	40	4	0.4	0.04	0.004	4 x 10 ⁻⁴
7 = 10 ⁻⁴	35	3.5	0.35	0.035	0.0035	3.5 x 10 ⁻⁴
4 x 10 ⁻⁴	. 20	2	0.2	0. 0 2	0.002	2-x -10 ⁻⁴

TABLE 4-28 (Continued)

Toxicity/ Hobility/	Bioaccumulation Potential Factor Value							
Persistence Factor Value	50,000	5,000	500	50	5	0.5		
2 x 10 ⁻⁴	10	1	0.1	0.01	0.001	1 x 10 ⁻⁴		
1.4×10^{-4}	7	0.7	0.07	0.007	7 x 10-4	7 x 10 ⁻⁵		
1 x 1074	5	0.5	0 05	0.005	5 x 10 ⁻⁴	5 x 10 ⁻⁵		
8 x 10 ⁻⁵	4.	0.4	0.04	0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵		
7 x 10 ⁻⁵	3.5	0.35	0.035	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵		
4 × 10 ⁻⁵	2	0.2	0.02	0.002	2 x 10 ⁻⁴	2 × 10 ⁻⁵		
2 x 10 ⁻⁵	1	0.1	0.01	0.001	1 x 10 ⁻⁴	1 x .10 ⁻⁵		
1.4 x 10 ⁻⁵	0.7	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶		
8 × 10 ⁻⁶	0.4	0.04	0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶		
7 x 10 ⁻⁶	0.35	0.035	0.0035	3.5×10^{-4}	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶		
2 x 10 ⁻⁶	0.1	0.01	0.001	1×10^{-4}	1 x 10 ⁻⁵	1 x 10 ⁻⁶		
1.4 x 10 ⁻⁶	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷		
8 x 10 ⁻⁷	0.04	0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷		
7 x 10 ⁻⁷	0.035	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶	3.5 x 10 ⁻⁷		
2 x 10 ⁻⁷	0.01	0.001	1 x 10 ⁻⁴	1 x 10 ⁻⁵	1 x 10-6	1 x 10 ⁻⁷		
1.4 x 10 ⁻⁷	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸		
8 x 10 ⁻⁸	0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸		
7 x 10 ⁻⁸	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶	3.5 x 10 ⁻⁷	5.5 x 10 ⁻⁸		
2 x 10 ⁻⁸	0.001	1 x 10 ⁻⁴	1 x 10 ⁻⁵	1 x 10 ⁻⁶	1 x 10 ⁻⁷	1 x 10 ⁻⁸		
1.4 x 10 ⁻⁸	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹		

TABLE 4-28 (Concluded)

Toxicity/ Hobility/ Persistence Factor Value	Bioaccumulation Petential Factor Value							
	50,000	5,000	500	50	5	0.5		
8 x 10 ⁻⁹	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷ .	4 x 10 ⁻⁸	4 x 10 ⁻⁹		
2 x 10 ⁻⁹	1 x 10 ⁻⁴	1 x 10-5	1 z 10 ⁻⁶	1 x 10 ⁻⁷	·1 x 10 ⁻⁸	1 x 10 ⁻⁹		
1.4 x 10 ⁻⁹	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10 ⁻¹⁶		
\$ x 10 ⁻¹⁰	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸	4 x 10 ⁻⁹	4 x 10-10		
1.4 x 10 ⁻¹⁶	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹ :	7 x 10 ⁻¹⁰	4 x 10-11		
1.4 x 10 ⁻¹¹	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹	: x 10 ⁻¹⁰	7 x 10 ⁻¹¹	7 x 10 ⁻¹²		
1.4 x 10 ⁻¹²	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10-16	7 x 10 ⁻¹¹	7 x 10 ⁻¹²	7 x 10-13		
0	. 0	0	o	0	0	0		

Do not round to nearest integer

4.2.3.2 Papulation Businets the population factor for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential contamination. Determine which factor applies to an intake Determine which factor applies to an intake as specified in section 4222. Determine the lation to be counted for that intake as specified in section 4.1.2.3.2, using the target distance limits in section 4.2:1.4 and the hazardous substance migration path in section 4.217

4.22.3.2.1 Level I concentrations. Assign a value to this factor as specified in sections 412322

422322 Lord II concentration e Kerim ine to this factor as specified in section 412222

4.223.23 Patential contomination: Per wach applicable type of surface water body in Table 4.28, determine the dilution oreighted Table 4-21, determine the dilution weight population value as specified in section 412324 Select the appropriate dilution weight adjustment value from Table 4-27 as specified in section 42221.

Calculate the value for the potential contamination factor (PC) for the watershed

$$PC = \frac{A}{10} \sum_{i=1}^{n} W_{i}$$

A=Dilution weight adjustment value from Table 4-27.

W₁=Distan-weighted population from Table 4-96 for surface wester body type L n=Number of different surface water body types in the wetershed

If PC is less than 1. do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Enter the value in Table 4-25

4.2.2.2.4 Calculation of population factor value. Sum the factor values for Level I concentrations, Level II concentrations, and entiel contamination. Do not round this

un to the meacest integer. Assign this sum as a population factor value for the watershed. the population factor viduo for Enter this value in Table 4-25.

42233 - Besources. Ass ion a value to the resources factor as specified in section 41222

4223A Calculation of drinking water threat-largets factor cotagory value. Sum the necessat latitus, population, and recourses factor values for the watershed. De not count factor values for the welershed. Do not you
this sum to the mercest integer. Assign this
sum as the drinking water threat-langers
factor category value for the watershed. Bu
this value in Table 4-23.

4.2.24 Calculation of drinking water
threat score for a watershed. Multiply the e for the watershed. Buter

threat score for a watershed Multiply the drinking under flavet factor category values for Multhood of release, weste characteristics, and targets for the watershed. and round the product to the nearest integer. Then divide by \$2,500. Assign the resulting value, subject to a maximum of 100, as the drinking water threat score for the watershed. Enter this score in Tabl

watershed. Enter this accre in Table 4-25.
4.23 Human food chain threat. Evaluate
the human food chain threat for a-watershee based on three factor categories: likelihood of release, waste characteristics, and targets.

4.23.1 Human food chain throatlikelihood of release. Assign the same likelihood of release factor category value for the human food chain threat for the watershed as would be assigned in section 4.2.2.1.3 for the drinking water threat. Enter this value in Table 4-25.

4232 Human food chain threat-waste characteristics. Evaluate the weste characteristics factor category for each watershed based on two factors: texticity/ mobility/persistence/bioaccumulation and

neardons weste quantity. 42321 Texicity/mobility/persistence/ lation. Evaluate all those hazardens substances eligible to be evaluated for toxicity/mobility/persistence in the drinking water threat for the watershed (see section 4.22.21).

4.23.2.1.2 Toxicity. Assign a toxicity factor value to each hazardous substance ens substance as specified in section 2411.

423212 Mobility. Accigs a gro water authility factor value to each lazardous substance as specified for the drinking water threat (see section 4.2.22.1.2).
423.2.1.3 Persistence Assign a surface

4.23.2.1.3 Personned Aranga a success water persistence factor value to each hazardous substance as specified for the drinking water threat (see section 4.2.2.2.3). except: use the predominant water category craming water used to estation 4.22.2.13; except: we fire predominant water category (that is, belies: or stwies, eccesse, constal tidal waters, or Great Lukes) between the probable point of entry and the measest finling (not the nearest drinking water or resources intake) neasest drinking water or resources surrey, along the hearndone substance migration path for the watershed to determine which portion of Table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2.

4.2.3.2.1.4. Bioaccumulation potential. A sign a bioaccumulation potential factor.

Assign a bioaccumulation potential favalue to each bazardous substance as specified in section 413211

423215 Calculation of toxicity/ mobility/persistence/bleecommission factor value. Assign each hexardous substance a tendelty/mebility factor value. from Table 3-0 (section 3.2.1.3), based on the values assigned to the largedous substance for the tenicity and mobility factors. Then medous sub moe e toxicity/ essign each hazardous substance a troicity mability/paraistunce factor values from Tab 4-26, based on the values assigned for the toxicity/mobility and pessistence factors. Then eacign each hazardous substance a toxicity/mobility/pensistence/ bioaccumulation factor value from Table 4-28. Use the sul rance with the highest toxicity/mebility/persistence/ bioaccumulation factor value for the watershed to assign the value to this factor for the watershed. Bater this value in Table 4-25

BILLING CODE 8000-00-10

4.23.22 Hambur wate quality. miga the same factor value for besselve ofly for the wetershed as would be a section 42.222 for the deleting d in sec

overgood in segme 422222 for the executing water deem. Buter this value in Table 4-25.
422323 Calculation of human fixed chain threat-water characteristics factor category value. For the humandous valuemer selected. for the waterhal in section 421215, ore its tendelly/mehilly/ punistance factor value and bioexternalation potential factor value as follows to earlier a value to the ware or mesons or mengs a venter to the venter characteristics finites enterprey. Piest, meltiply the tendelty/meltillay/pendetesies factor value and the beamfans weste depaths factor و مواد ple quantity for a making to a and the between wrote quantity factor value for the untwilled, polypist to a uncoloring product of 15/30°. Then moltiply this product by the biomeromolelian potential factor value for this hasterdown substance. Sector velos for this hastardous exhetance, subject to a maximum product of 1×10¹⁰. Brand on this sectod product, sonips a value from Thirle 5-7 (section 2473.1) for the human food challs three ventes the texticities factor category for the watershiel. Better this value in Table 4-25.

4.2.3.2 Hence food chain threat tageth.
Include two larget factors for the weighth.
Include their talkeled and population.
Put both factors determine whether the
most delivation are emblet to Level !

mpt Relievies are orbited to Lovel I exemplation, Lovel II representation, or strated house first diplo continuentes. Internation which applicate much Releasy for infinity of a fishery) as specified in section 133, adjust to the motificians specified in reliesp (211) and (211).

42223 - Part chair institution Acetys o vides to the field shall institution to graphed in against 42242 with the within to the field chain individual factor on apperficiel in agains 4.2.84.2 with the following the distribution. White a distribution weight in med, untilply the expression dilution weight from Table 4-27, as qualified in continue 42.2.2.2. Due the remarking product, not the viduo Sion Table 4-23, on the dilution weight in antiquing the factor value. Do not remark this product to the nearest histogra- Enter the value designed in Table 4-25. Table 4-55.

4.2.3.2 Appointing Britante the population factor for the westershed based on those factors: Lord I continuential human food close contestions, and potential human food close contestions. Detection which of siled to each fathery led in out 4222

423321 Level I concentrations. Assign a value to this factor on specified in section 413321. Buter this value in Table 4-25.

42.3.3.2.2 Lovel II concentrations. Assign a value to this factor as specified in section 4.1.3.3.2.2 Better this value in Table 4-25.

4.1.3.2.2 Enter this velue in Table 4-25.
4.2.3.2.3 Potential beams fined chain contembration. Assign a velue in this factor as specified in section 4.1.3.2.2 with the following modification. Per each fishery being evaluated, ambigly the appropriate dilution velight for that fishery from Table 4-23 by the adjustment velue extend from Table 4-27, as modified to a selected from Table 4-27. **4** 4-27. notified in section 4.2.2.3. Use the as specified in second values are very reaching product, and the value from Table 4–13, as the dilution weight for the Schoop. Do not round this product to the unwent integer. Easy the value conjunct in Table 4–25. 4.2.5.2.6 Calculation of population factor value. Sain the factor values for Levil 1 value. Sain the factor values for Levil 1

reasonabilisms, Lovel Y controversions, and potential lumen feed chain controversionies for the watersholder. Do not record this con to the reasonal integer. Assign this cam as the population factor value for the watersholder. er this value in Table 4-25.

Calculation of Suman food claim food-largits factor category value. Sum the lead chain individual and physicism factor values for the watershed. Do not result this um to the normal integer. Assign this man air he luman that chain throughputs factor stagery unlies to the fiel chain threst targets factor : for for the watershed. Buter this

category value for the vesticated. Buter this value to Table 4-35. -4.24.4. Valualative of historic field chiefs should across five a vesticated historic fall luman field chief the factor category values for Hailbood of substance vestic values for Buillacid of substate, weeks characteristics, and targets for the vestraded, and strend for the securit integer. Then divide by \$2,500. Assign the resulting value, subject to a succlasses of \$61, or the human final closic threat screen for the vestrathed. Better this posses to Table 4-45, 4.24. Berkinsmanned threat. Beakers the

ALAA Berbinspasse dooks. Brown and ALAA Berbinspasse for the waterhal based on these factor categories: Hullband of micros, waste characteristics, and trapes.

ALAA Berbinspassed Characteristics, and trapes.

ALAA Berbinspassed Characteristics of the categories. factor category value for the environmental theories the workshed as would be assigned in section 4.2.2.1.3 for the disipling water thous. Buter this relies in Table 4-25.

4242 Breitenmental threat-treats characteristics. Business the wester characteristics factor cutegory for each wetershed based on two factors: ecrepoten tenticity/mehitty/persistence/ bioaccumulation and hexardous waste

4.2.4.2.1 Bossystem toxicity/sociality/ persistence/bioaccumulation. Brelease all

these hamelous substances eligible to be evaluated for tendely/mobility/paraistence in the delaining water threat for the watershed (see section 4.2.2.2.1).

42.4.23.3 Respector tecksity. Assign as consented training factor value to each humandous substance as specified in section 414211

424212 . Mobility. Angign a ground water mobility factor within to each manuface substance as specified in section 422212 for the delabling reptor threat.
424213 Provintance. Assign a such

4.24.21.3 Passistance, Assign a switce water pursistance finites value to each humalous substance, as specified in section 4.22.21.5 for the delabling water threat, energic one the pushaghant water category (that is, labor; or rivers; occases, occased tidal waters, or Guest Labor) between the probability. rint of entry and the request remailire wherever (not the pointed Arisking we or specimen intoles; along the homedown exhause sulpation path for the watershed intotures injustice path for the well-rised to detaining which parties of Table 4-16 to size. Delivative the productional water category based on distance as specified in section 4372212.

42.4.2.14. Emopius bisecommulation petastici. Anign an ecosystem bisecomplation potastical factor value to each humphus substance as specified in main tillia

section 43.4213.

42.4213. Colpulation of ecosystem
texticity/mobility/possistence/.
Afraccambatter fector subse-Aeriga sectionadess exhibitors on ecosystem texticity
mobility factor value from Table 8-0 (sectio
3.21.3), based on the values easigned to the control on the walk residues substance for unicity and substitly fact with houseless enbetween michigant file. es. Then assign hatanes en eco rch hannelens entermere un versymme nicity fanklity / paneletmon factor value am Table 4-th, lineal on the value religioid for the versystem tendelty/mobility in factors: There are m each existing: Income name of the tericity/ siene estatence en occapitem tericity/ incomendation factor mehitty/pendetennificience mehic from Tuble 4-30, based on the veloci mehic from Tuble 4-30, based on the velocity value from Table 4-40, based on the values assigned for the computem tericity/publicy/publicy/publicy/publicy/publicy/publicy/solution-sol value in Table 4-25.

MATTER COME CONTRACT

TABLE 4-29
ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES®

Ecosystem	Persistence Factor Value					
Toxicity/Mobility Factor Value	1.0	0.4	0.07	0.0007		
10,000	10,000	4,000	700	7		
2,000	2,000	800	140	1.4		
1,000	1,000	400	70	0.7		
200	200	80	14	0.14		
100	100	40	7	0.07		
20	20	8	1.4	0.014		
10	10	4	0.7	0.007		
2	2	0.8	0.14	0.0014		
1	1	0.4	0.07	7×10^{-4}		
0.2	0.2	0.08	0.014	1.4×10^{-4}		
0.1	0.1	0.04	0.007	7 x 10 ⁻⁵		
0.02	0.02	0.008	0.0014	1.4×10^{-5}		
0.01	0.01	0.004	7 x 10 ⁻⁴	7 x 10 ⁻⁶		
0.002	0.002	8 x 10 ⁻⁴	1.4 x 10 ⁻⁴	1.4×10^{-6}		
0.001	0.001	4 x 10 ⁻⁴	7 ж 10 ⁻⁵	7 x 10 ⁻⁷		
2 x 10 ⁻⁴	2 x 10 ⁻⁴	8 x 10 ⁻⁵	1.4 x 10 ⁻⁵	1.4×10^{-7}		
1 × 10 ⁻⁴	1 x 10 ⁻⁴	4 x 10 ⁻⁵	7 × 10 ⁻⁶	7×10^{-8}		
2 x 10 ⁻⁵	2 x 10 ⁻⁵	8 x 10 ⁻⁶	1.4×10^{-6}	1.4 x 10 ⁻⁸		
2 x 10 ⁻⁶	· 2 x 10 ⁻⁶	8 x 10 ⁻⁷	1.4×10^{-7}	1.4×10^{-9}		
2 x 10 ⁻⁷	2·x 10 ⁻⁷	8 x 10 ⁻⁸	1.4 × 10 ⁻⁸	1.4 x 10 ⁻¹⁰		
2 x 10 ⁻⁸	2 x 10 ⁻⁸	8 x 10 ⁻⁹	1.4 x 10 ⁻⁹	1.4 x 10 ⁻¹¹		
2 x 10 ⁻⁹	2 x 10 ⁻⁹	8 x 10 ⁻¹⁰	1.4×10^{-10}	1.4 x 10 ⁻¹²		
0	0	0	O	o		

^{*}Do not round to nearest integer.

TABLE 4-30
BCOSYSTEM TOXICITY/NOBILITY/PERSISTENCE, TOACCUMULATION FACTOR VALUES.

Ecosystem Toxicisy/ Mobility/ Persistence	Ecosystem Bioaccumulation Potential Factor Value								
Factor Value	50,000	5,000	500	50	5	0.5			
10,000	5 x 10 ⁸	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000			
4,000	2 x 10 ⁸	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000			
2,000	1 x-10 ⁸	1 x 10 ⁷	1 x 10 ⁶	1 x 10 ⁵	1 x 10 ⁴	1,000			
1,000	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500			
800	4-x 10 ⁷	4 x 10 ⁶	4 x 10 ⁵	4 x 10 ⁴	4,000	400			
700	3.5 x 10 ⁷	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350			
400	2 x 10 ⁷	2 x 10	2 x 10 ⁵	2 x 10 ⁴	2,000	200			
200	1 x 10 ⁷	X x 106	1 x 10 ⁵	1 x 10 ⁴	1,000	100			
140.	7 x 10 ⁶	7 x 10 ⁵	7 × 10 ⁴ .	7,000	700	70_			
100	.5 x 19 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50			
80	4 x 10 ⁶	4 x 10 ⁵	€x 104	4,000	400	40			
70	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35			
40.	2 x 10 ⁶	2 x 105	2 x 10 ⁴	2,000	200	20			
20	1 x 10 ⁶	1 x 10 ⁵	1 x 10 ⁴	1,000	180	10			
14	7 x 10 ⁵	7 x 10.4	7,000	700	70	7			
10	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50	5			
8	4 x 10 ⁵	4 x 10 ⁴	4,000	400	40	•			
7	3.5 x 10 ⁵	3.5 x 10 ⁶	3,500	350	35	3.5			
4	2 x 10 ⁵	2 x 10 ⁴	.2,060	280	20	2			
2	1 x 10 ⁵	1 x 10 ⁴	1,900	100	. 10				
1.4	7 x 104	7,000	700	70	7	0.7			

TABLE 4-30 (Continued)

Ecosystem Toxicity/ Mobility/	Esosystem Bioaccumulation Potential Factor Value						
Persistence Factor Value	50,000	5,000	500	50	5	0.5	
1.0	5 × 10 ⁴	5,000	500	50	5	0.5	
0.8-	4 × 10 ⁴	4,000	400	40	4	0.4	
0.7	3.5 x 10 ⁴	3,500	350	35	3.5	0.35	
0.4	2 x 10 ⁴	2,000	200	20	2	0.2	
0.2	1 x 10 ⁴	1,000	100	10	1	0.1	
0.14	7,000	700	70	7	0.7	0.07	
0.1	5,000	500	50	5	0.5	0.05	
0.08	4,000	400	40	4	0.4	0.04	
0.07	3,500	350	35	3.5	0.35	0.035	
0.04	2,000	200	20	2	0.2	0.02	
0.02	1,000	100	10	1	*; 0.1	0.01	
0.014	700	70	7	0.7	0.07	0.007	
0.01	500	50	5	0.5	0.05	0.005	
0.008	400	40	4	0.4	0.04	0.004	
0.007	350	35	3.5	0.35	0.035	0.0035	
0.004	200	20	. 2	0.2	0.02	0.002	
0.002	100	10	· 1	0.1	0.01	0.001	
0.0014	70	. 7	0.7	0.07	0.007	7 x 10 ⁻⁴	
0.001	50	5	0.5	0.05	0.005	5 x 10 ⁻⁴	
8 x 10 ⁻⁴	40	4	0.4	0.04	0.004	4 x 10 ⁻⁴	
7 x 10 ⁻⁴	35	3.5	0.35	0.035	0.0035	3.5 x 10 ⁻⁴	
4 x 10 ⁻⁴	20	2	0.2	0.02	0.002	2 x 10 ⁻⁴	

TABLE 4-30 (Continued)

Ecosystem Toxicity/ Mobility/		Ecosystem Bi	oaccumulation	Potential Fa	octor Value	
Persistence Factor Value	50,000	5,000	500	50	5	0,5
2 x 10 ⁻⁴	10	1	0.1	0.01	0.001	1 × 10 ⁻⁴
1.4 x 10 ⁻⁴	7	0.7	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵
1 x 10 ⁻⁴	5	0.5	0.05	0.005	5 x 10 ⁻⁴	5 x 10 ⁻⁵
8 x 10 ⁻⁵	4	0 4	0.04	0.064	4 x 10 ⁻⁴	4 x 10 ⁻⁵
7 x 10 ⁻⁵	3.5	0.35	0.035	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵
4 x 10 ⁻⁵	2	0.2	0.02	0.002	2 × 10 ⁻⁴	2 x 10 ⁻⁵
2 x 10 ⁻⁵	1	0.1	0.01	0.061	1 x 10 ⁻⁴	1 × 19 ⁻⁵
1.4 x 10 ⁻⁵	0.7	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 × 10 ⁻⁶
8 × 10 ⁻⁶	0.4	0.04	0.00 4	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 × 10-6
? x 10 ⁻⁶	0.35	0.035	0 0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵	3 5 x 10 ⁻⁶
2 x 10 ⁻⁶	0.1	0.01	0.001	1×10^{-4}	1 x 10 ⁻⁵	1 × 10 ⁻⁶
1.4 x 10 ⁻⁶	0.07	0.007	7 × 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 × 10 ⁻⁷
8 x 10 ⁻⁷	0.04	0.004	4 x 10 ⁻⁴	4 × 10 ⁻⁵	4 x 10 ⁻⁶	4 × 10 ⁻⁷
7 × 10 ⁻⁷	0.035	0.0035	3.5×10^{-4}	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶	3 5 x 10-7
2 x 10 ⁻⁷	0.01	6 09:	1 x 10 ⁻⁴	1 × 10 ⁻⁵	1 × 10 ⁻⁶	1×10^{-7}
1 4 x 10 ⁻⁷	0.007	7 × 10-4	7 x 10 ⁻⁵	7 × 10 ⁻⁶	7 x 10 ⁻⁷	7 × 10-8
8 x 10 ⁻⁸	0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 × 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸
? x 10 ⁻⁸	0.0035	3.5 × 10 ⁻⁴	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶	3.5 x 10 ⁻⁷	3.5 x 10 ⁻⁸
2 x 10 ⁻⁸	0.001	1 × 10 ⁻⁴	1 x 10 ⁻⁵	1 × 10 ⁻⁶	1 × 10 ⁻⁷	1 x·10-8
4 x 10 ⁻⁸	7 x 10 ⁻⁴	7 × 10 ⁻⁵	/ x 19 ⁻⁶	/ x 10 ⁻⁷	/ x 10 ⁻⁸	7 ж 10 ⁻⁹

TABLE 4-30 (Concluded)

Ecosystem Toxicity/ Mobility/	Ecosys	tem Bioaccum	ulation Pote	ential Facto	or Value	
Factor Value	50,000	5,000	500	50	5	0.5
8 x 10 ⁻⁹	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸	4 x 10 ⁻⁹
2 x 10 ⁻⁹	1 x 10-4	1 x 10 ⁻⁵	1 x 10 ⁻⁶	1 × 10 ⁻⁷	1 x 10 ⁻⁸	1 x 10 ⁻⁹
1.4 x 10 ⁻⁹	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 × 10-10
8 x 10 ⁻¹⁰	4 x 10-5	4 x 10-6	4 x 10 ⁻⁷	4 x 10 ⁻⁸	4 x 10 ⁻⁹	4 x 10-10
1.4 x 10 ⁻¹⁰	7 x 10-6	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10 ⁻¹⁰	4 x 10-11
1 4 x 10-11	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10 ⁻¹⁰	7 x 10 ⁻¹¹	7 x 10 ⁻¹²
1 4 x 10 ⁻¹²	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10 ⁻¹⁰	7 x 10 ⁻¹¹	7 x 10 ⁻¹²	7 × 10 ⁻¹³
. 0	0	o	٥	0	0	O

²Do not round to nearest integer.

EXLUNG CODE 6568-60-C

4.2.4.2.2 Historians waste quantity.
Assign the same factor value for hearedown
waste quantity for the watershed as would be
assigned in section 4.2.2.2.2 for the drinking
water fluest. Bater this value in Table 4-25.
4.2.4.2.3 Calculation of continuumstal
direct-waste characteristics factor category
when the de homestern selected.

value. For the homodous substance relacted for the westerhool in copius 4,2,4,2,1,5, use its yeles tricky/mobiley/persistence or value and ecosystem bioseccumulation iel factor value as fallows to assign a colugary. Plot, unlighly the ecosystem tericity/mehitty/petaletunce factor value and the beautique unate second e to the wests characteristics factor noticity/mobility/porolateuro factor value and the beambas variet quantity factor value for the watershoot, askject to a mentioning product of 1×39°. Then mobility this product by the occupation bisoccumulation potential factor value for this hammious substance, subject to a mentioning product of 1×39°. Insted on this moduct, nation a union from 7-blue 4.° ign a value from Table 3-7 orden 2431) to the embermental firest غبه حاباد gary for the

reteched. Unter the value in Table 4-25.
42.43 Aminomental three-largets related to the confirmation of th octor entegery for a vestephod using one scler entegery for a vestephod using one scler; presides environments. A2453 Sanathre amiroments. Brok-nations environments for the universe.

editivo escituanemis for the vesterabel red en there factors: Level I reasterations, Level II concentrations, en untied contemberties. Determine which abelient, and Rujes vėlicė lies to each sometime envisorment or d in secti # 41411, except use only because it seems to surface water in-rates enginest and only these homeless whethers is such complex that most the Monte in statio -4213 md 4214

424211 Level I concentrations. Assign a shee to this factor as specified in section 424211 Across on specified to pro-414111 Bir die vo

424312 Level II conce tions. As a value to this factor as specified in section 4.14.3.1.2 Better this value in Table 6-25. 424313 Potential contr

mination. Assign a value to this factor as specified in section

41.43.13 with the liboving modification.
Meltiply the appropriate dilution weight from
Table 4-23 for the sensitive environments in each type of surface water body by the adjustment value selected from Table 4-27, as specified in section 4.2.2.1. Use the resulting product, and the value from Table 4-21 as the dilution of the resulting product. act, not the value from Table 4-13, as the dilution weight for the sensitive ments in that type of surface water body. Do not round this product to the est integer. Bater the value assigned in Table 4-25.

454314 Calculation of aurigonomental these terpet-factor category value. Sum the value for Level I concentrations, Level II concentrations, and petential confemination for the watershod. Do not round this sum to the nearest integer. Assign this sum as the environmental threat targets factor category value for the watershed. Enter this value in Table 4-25.

4244 Calculation of contractmental these score for a votershed. Multiply the continuousled theset factor category volume for Hulthood of release, weste chancteristics, and targets for the watershed, and sound the product to the nearest integer. Than divide by \$2,500. Assign the resulting value, subject to a susciouse of \$0. as the atal threat score for the wetershed. Bater this score in Table 4-25.

4.2.5 Calculation of ground water to surface swater migration component score for a systemical Sum the access for the those threate for the westershed (that is, drinkin man food chain, and environm threats). Assign the resulting score, subject to no value of 100, as the ground water to surface water migration compon for the wetershed. Enter this score in Table

4.28 Calculation of ground water to surface water migration component scare. Select the highest ground water to surface water migration component score from the water migra is evaluated. Assign this score as the ground water to surface water migration component score for the site, subject to a

m scare of 100. Buter this score in Table 4-2

4.3 Calculation of surface water ignation pullowy scare. Determine the uface water migration pulloway score as

 If only one of the two surface water ignation components (overland/flood or round water to surface water) is scored. nd water to summe -----, ps the score of that component as the ace water migration pathway score. If hoth components are scored, select the

· If both comp higher of the two component screen from sections 4.16 and 4.28. Assign that score as the surface water migration pathway score.

50 Sell Exposure Peterny

Brahate the cell expense pathway based on two threats: Resident population threat and nearby population threat. Brahaste both d on three factor categories: mate be Librihood of exposure, waste characteristics, and targets, Figure 5-1 indicates the factors included within each factor category for each

type of threat.

Datacaine the sell exposure petimey score (S.)In terms of the factor category values as

The same of

LE,—Likelihood of exposure factor category value for threat i (that is, resident population threat or nearby population threat).

WC,=Waste characteristics factor category ine for threat i.

 $T_i = T$ argets factor category value for threat i. SF = S calling factor.

Table 5-1 outlines the specific calculation

PRIAME COST COST COST

Likelihood of Exposure (LE) Waste Characteristics (WC) Targets (T) Toxicity Observed Contamination Resident Individual Resident • Chronic Resident Population Population Area with Resident · Carcinogenic Targets · Level I Concentrations . Acute . Level II Concentrations Hazardous Waste Quantity Workers · Hazardous Constituent Resources Quantity Terrestrial Sensitive · Hazardous Wastestream Environments Quantity • Volume · Area Likelihood of Exposure (LE) Waste Characteristics (WD) Targets (T) Toxicity Nearby Individual Attractiveness/ Nearby Accessibility • Chronic Population Within One Mile Population · Carcinogenic Area of Contamination • Acute Hezardous Waste Quantity . Hazardous Constituent Quantity . Hazardous Wastestream Quantity · Volume . Area Figure 5-1

OVERVIEW OF SOIL EXPOSURE PATHWAY

BILLING CODE 4586-56-

TABLE 5-1.—SOIL EXPOSURE PATHWAY SCORESHEET

Buddent Population Threat	1	
· · · · · · · · · · · · · · · · ·	i	
Unafficial of Exposure	l-	i
1. Linkout of Epone	580	I
	ŀ	i
9 Bridge .	₩	l
1 Nasabas Wate Overfix	I 🙀	I
4. The Commission	100	
Desile	1	j
S. Problem (military)		
S. Resident Individual 6 Resident Republics:		
Qs. Land I Concentrations	•	i
· D. Constitution] 🚟	! ==
Co. Resident Population (from the + Co)	80 80 15	1
7 White	3 %	1
7. Wadana.	5	l —
3. Provided Sandha Endoward	i ii	
19. Targets (tree 5 + 6: + 7 + 0 + 9] =	
Berkhard Brendeline Brend Brend	1. •	! —
11. Reddent Republica Threat (Inns 1 × 4 × 10)		1
Hundry Population Threat		ļ —
Uniform of Process		l
12 Aleginass/Accessing	180	l
12 Ann of Controlled to	. 100	
M. I. Martin of Street		
The Constitution	1	i —
45 Teach	₩	i
14. Unificated of Exposite Waste Characteristics 16. Number Waste Character 11. Number Waste Character	1 =	l —
7. West Comments		I —
Secretaria	!	i —
18. Heaty habital		İ
	! 📥 :	
		_
Healty Population Threat Storm 21. Realty Population Threat (free 14 × 17 × 38)	1 ***	
Of Broke Smith Street S		i
St. many Proposed House State In X 17 X con	1	i
22. Sel Expense Pathway Store * (S.), (thus (11+21) / 82.99), subject to a maximum of 109)		

- tradement value applicate to versito characteristics category.

 Lectural value and application.

 I provide a constructive applies to factor. However, pathway accord based solely on terrestrial benefitive environments in finited to maximum of 60 and record to maximum laborateristics for the construction of

\$41 General contride ecions. Doubeste the n polimery based an areas of

- nation observed on ation to be recent at compling local ridence indicates that: g locations where analytic
 - A homodous pubetance ettributable to the offic is present at a concentration algorificantly above background levels for the one from Table 2-3 in section 2.3 for the calenda for determining ensiytical significance), and -This hexardens substance, if not poss

at the surface, is covered by 2 fept or less of cover material (for example,

- Establish sense of observed outsminutes besed on sampling locations t which there is observed contamination as
 - For all sources except contaminated sell, if observed contamination from For all see the alte is present at any sampling location within the source, consider that entire source to be an area of observed contamination. orientes.
 - suitated sail, consider both the -Fer cu pling location(s) with observed ation from the site and the ren lying between such locations to be an area of observed contamination.

unless available information indicates otherwise.

- . If an area of observed contamination (or parties of such an area) is covered by a ent or otherwise maintained. permental, or outstware mentioned, essentially impensionable meterial (for example, asphalt) that is not more than 2 feet thick, exclude that area (or portion of the area) is evaluating the soil exposure
- . For an area of observed contamin consider only these hexardous substances that most the criteria for observed n for that area to be associate with that area in evaluating the soil exposure pathway (see section 2.2.2).

 If these is observed contact

ir there is observed contamination, essign scores for the resident population threat and the nearby population threat, as specified in sections \$1 and \$9 if these, sections \$1 and \$2. If there is no observed contamination, assign the soil exposure pathway a score of 0.

- 5.1 Resident Population Threat. Evaluate the resident population threat only if there is an area of observed contamination in one or ere of the following locations:
- . Within the property boundary of a residence, school, or day care center and within 200 feet of the respective residence. school, or day care center, or
- · Within a workplace property boundary and within 200 feet of a workplace area, or

- · Within the boundaries of a resource specified in section 5.1.3.4, or

 • Within the boundaries of a terrestrial
- mailive covironment specified in section 5135

If not, seeign the resident population threat a value of 0, outer this value in Table 5-1, and proceed to the nearby population threat (section 5.2). 5.1.1 Libelli

- 5.1.1 Libelihood of exposure. Assign a value of 500 to the Hallhood of exposure factor category for the resident population throat if there is an asse of observed ation in one or more locations listed in section S.1. Enter this value in Table 5-1.
- 5.1.2 Weste characteristics. Evaluate waste characteristics based on two factors: teoricity and hazardous waste quantity. Evaluate only those hazardous substances that most the criteria for observed
- contamination at the afte (see section 5.0.1).
 5.1.2.1 Taxicity. Assign a toxicity factor value to each hexardous substance as specified in section 24.1.1. Use the hexardous substance with the highest toxicity factor value to assign the value to the toxicity-factor for the resident population threat. Enter this value in Table 5-1.
- \$.1.2.2 Hazardous waste quantity. Assign hazardous waste quantity factor value as specified in section 2.4.2. In estimating the hazardous waste quantity, use Table 5-2 and

 Consider only the first 2 feet of depth of an area of observed contamination, except as specified for the volume measure.

 Use the volume measure (see section 2.4.2.1.3) only for those types of areas of observed contamination listed in Tier C of Table 5-2 in evaluating the volum for these listed areas of observed contamination, use the full volume, not just the volume within the top 2 feet.

• Use the area measure (see section 2.4.2.1.4), not the volume measure, for re: for all other types of areas of observed nation, even if their volu

Enter the value assigned in Table 5-1.

TABLE 5-2-HAZARDOUS WASTE QUAN-TITY EVALUATION EQUATIONS FOR SOIL EXPOSURE PATHWAY

Tier	Megaure	-Units	Equation for assigning value			
A ,	Hezerdoue Constituent	ь	С			
8+	Hexardous Wastrokeen	ь	W/5,000			
C'	Quantity (W) Volume (V) Surface	yda	V/25			
	Impoundment * Drume * Tanks and	geton yd ^a	V/500 V/2.5			
Deco	Containers Other Then Drine Area (A)	_				
	Lendill' Surface Impoundment	*	A/34,000 A/13			
· · • ·	Surface impoundment (Buried/backfilled)		A/13			
	Land treatment Pile * Contaminated Soil	No.	W34,000			

. Do not round not

Convert volume to mass when necessary: 1 ton =2,000, pounds=1 cabic yard=4 drams=200

gallons.

* Use volume measure only for surface impoundments containing hearnfolds substances present as liquids. User area measures in Tier D for dry surface impoundments and for buried/backfilled surface-im-

poundments.
4 % actual volume of drums is unuvalishin, assume

1 drams-50 pations,
"Use Inno serice area under pile; not surtace
area of pile.

5.1.23 Calculation of waste cherocteristics factor category value. Multiply the toxicity and hazardous waste quantity factor values, subject to a maximum product of 1 × 10°. Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 5-1.

5.1.3. Targets. Evaluate the targets factor category for the resident population threat based on five factors: resident individual. resident population, workers, resources, and terrestrial sensitive environments.

In evaluating the targets factor category for the resident population threat, count only the following as targets:

· Resident individual—a person living or attending school or day care on a property with an area of observed contamination and whose residence, school, or day care center, respectively, is on or within 200 feet of the ares of observed contamination.

· Worker—a person working on a property with an area of observed contamination and whose workplace area is on or within 200 feet of the area of observed contamination.

· Resources located on an area of observed contemination, as specified in section 5.1.

· Terrestrial sensitive environments located on an area of observed minetion, as specified in section 5.1.

5.1.2.1 Resident individual Evaluate this factor based on whether there is a resident individual, as specified in section 5.1.3, who is subject to Level I or Level II concentrations

First, determine those areas of observed contamination subject to Level I concentrations and those subject to Level II concentrations as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 5-3 in determining the level of contamination. Then seeign a value to the resident individual factor as follows:

. Assign a value of 50 if there is at least one resident individual for one or more areas subject to Level I concentrations

Assign a value of 45 if there is no such resident individuals, but there is at least one resident individual for one or more areas subject to Level II concentrations.

Assign a value of 0 if there is no resident individual.

Enter the value assigned in Table 5-1. 5.1.3.2 Resident population. Evaluate resident population based on two factors: Level I concentrations and Level II concentrations. Determine which factor applies as specified in sections 2.5.1 and 2.5.2. using the health-based benchmarks from Table 5-3. Evaluate populations subject to Level I concentrations as specified in section 5.1.3.2.1 and populations subject to Level II concentrations as specified in section 5T322

TABLE 5-3:--HEALTH-BASED BENCH-MARKS FOR HAZARDOUS' SUBSTANCES IN SOILS

 Screening concentration for cancer corresponding to that concentration that corresponds to the 10⁻⁴ individual cancer risk for oral exposures.

 Screening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for oral exposures.

Count only those persons meeting the criteria for resident individual as specified in

section 5.1.3. In estimating the number of people living on property with an area of observed contac mination, when the estimate in based on the number of residences. multiply each residence by the average number of persons per residence for the county in which the residence is located.

5.1.3.2.1 Level I concentrations. Sum the comber of resident individuals subject to Level I concentrations and multiply this sum by 10. Assign the resulting product as the value for this factor. Enter this value in Table 5-1.

5.1.2.2 Level E concentrations. Sum the number of resident individuals subject to
Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 5-1.

5.1-3.2.3 Calculation of resident population factor value. Sum the factor nes for Level I concentrations and Level II concentrations. Assign this sum as the resident population factor value. Enter this value in Table 5-1.

5.1.3.3 Workers. Evaluate this factor based on the number of workers that meet the section 5.1.3 criteria. Assign a value for these workers using Table 5-4. Enter this value in Table 5-1.

- TABLE 5-4.-FACTOR VALUES FOR WORKERS

Number of workers		Assigned value
0	_	0
101 to 1,000		10 15

5.1.3.4 Resources. Evaluate the resources factor as follows:

 Assign a value of 5 to the resources factor if one or more of the following is: present on an area of observed contamination at the site:

-Commercial agriculture.

Commercial livestock production or commercial livestock grazing.

. Assign a value of 0 if none of the above are present.

Enter the value assigned in Table 5-1.
51.35 Terrestrial sensitive environments. Assign value(s) from Table 5-5 to each driel sen sitive environment that meets the eligibility criteria of section 5.1.3.

Calculate a value (ES) for terrestrial sensitive environments as follows:

where

S₁=Value(s) assigned from Table 5-5 to terrestrial sensitive environment i.

mier of temostrial executive releasests mostley section 5.1.3

programmente in Medical Lagration de marchal e the petter Languages ----to a maximum of th, determine the value for the temestale penaltive contrasments factor

TABLE 5-5.—PERRESTRIAL SENSITIVE BROWNINGS RATING VALUES

Terrolid souths entranses	**
Toward other being to Federal despects or Seat- and garden. Melling Park Despects Federal Wildowsen.	***
Redered Managed Terrested Setting Impair by the count by Pedered designated or proposed Securities or contingued species	75
Pedend bird designated for pro- traction of extend competence. Administratively proposed Pedends Williamson Area Toronthis copes of disease appropri- tions of palents. Tops of palents.	
Tempated building features to be exced by State designated endangared or tempeted or tempeted or tempeted building features to be readed by quadra under contrast to be Featured designation endangared or tempeted states.	
State lands designated for widdle or game consequent lingual Acres Parts designated lingual Acres Particular count, established in disa, Impacted to residencess of unique bigits operated in	8

^{*}College fraktus are desired in 50 CFR 404.05.
*Limb to ventricate species.

- Multiply the values assigned to the statest population threat for illustrated of spoons (LI), waste characteristics (WC), ad IS. Divide the parefact by 82,500.
 - -If the result is 40 or lass, earlies the value IS or the temperal semattive conferences in facility value.
 - If the result exceeds 60, calculate a value BC as fallows

ratings the value BC as the terrestrial sensitive ouvisuuments factor value. Do not round this value to the nequest interper.

rand this value to the necessary manager.
Rater the value assigned for the terrestrial statistic environments factor in Table 5-1.
S.1.3.6 Coloristies of resident population regular factor category value. Sum the values terputs factor cutepary reduc. Sum | for the resident judiridual, resident perdefine, weeking, necessaries, and terrestrial smallive environments factors. Do not round to the nearest integer. Assign this sum as the targets factor category value for

the resident pape ties threat. Enter this value in Table 5-1.

S.1.A Calculation of resident population threat scare. Multiply the values for inalhood of experse, waste characteristics, and tength for the resident population threat; and round the protect to the nearest integer.

Assign this product so the resident population threat scare. Beter this score in Table S-L

5.2 Marty population throat Include in the upacky population only those individual who live or otherd school within a 1-mile travel distance of an area of observed contamination at the after and who do not most the criteria for surident incitridual as specified in section \$.1.3.

Do not consider arous of observed minution that have an attractiveness/ accessibility factor value of 0 (see section \$21.0 in evaluating the nearby population

5.2.1 Likelihood of exposure. Breins two factors for the Melihood of exposu factor category for the nearby population threat attractiveness/accessibility and area

\$211. Affractivance/accountility. Assign a value for etherstrances/ fidity from Tuble 5-6 to each uses of observed continuination, excluding any land used for maidment. Select the highest value project to the areas evaluated and use it as the value for the effectiveness/accordistly factor. Beter this value in Table 5-1.

\$2.1.2 Asse of contemination. Brainste res of contamination based on the total area of the seems of observed contemination at the site. Count only the security that meet the criterie in section S.A.1 and that receive an attractiveness/accombility value greates than 0. Assign a value to this factor from Table 5–7. Satur this value to Table 5–1.

TABLE 5-6.--ATTRACTIVENESS/ ACCESSIBILITY VALUES

Area of appared contamination	1
Designated representational area	160
Regularly used for public secretion (for example, fabring, taking, political,	75
for example, vecant left in orber and	75
grand road, with some public recree-	_
Sightly acceptable for eventure, ex- tremely used area with no road in-	50
providing, with some public recrea- tion gas	8
Acceptable, with no public recreation uses	10
combination of maintained fence and	5
Physically ingortantile to public, with no evidence of public increasion use	. •

TABLE 5-7.--AREA OF CONTAMINATION FACTOR VALUES

Total area of the error of charmed contactant frames had	-
Last this or equal to \$400	5 20 40 66 50 100

5.2.1.3 Likelikood of exposure factor desargy value. Assign a veloc from To-2.2.3 Likelihood of expensive preserve cutogray value. Assign a value from Table 5-0-to fits likelihood of superates factor category, based on the values extigued to the attentiveness/accessibility and area of continuination factors. Enter this value in

TABLE 5-8.—NEMBY POPULATION LIKELI-HOSD OF EMPOSURE FACTOR VALUES

Arts of contamination factor	Attractiveness/accomplishy factor value						
Titles	180	75	8	Ħ	10	5	6
100	=	25	375	2	15	30 30	0
			150	8 10	5	5	00
5	15	25	5	5	5 5 5	5 5	•

5.2.2 Westerchampeteristics. Evaluate \$22 Wester characteristics broad on two factors: terricity and harmolous weste quantity. Brainate only those harmolous substances that most the calacia for observed controlled for section S.D.1) at seem that can be swigned an atherformers/ accombility factor value greater than 0.

S221 Tensishe senior protes than 0. S221 Tensishe Amign a tensishy factor where a specified in section 2.4.1.1 to each autohou substance mosting the criteria in scales 5.2.2. Use the humadous substance with the habitance. econe a.c. Use up manager retection with the highest tenicity factor value to eater the value to the tenicity factor for the early population threat. Bater this value in

5.2.22 Hangalous waste quantity. Assign a value to the hannelman waste quantity factor as specified in section 5.1.2.2. except: consister and others. factor as specified in section 5.1.22 cocep-consider only these section of observed continuation that can be assigned an attractiveness, accessfully factor value greater than 0. Enter the value assigned in ble 5-1.

5223 Calculates of maste 5.2.23 Constitute of veneral characteristics factor category value. Multiply the tradety and hexardous waste quantity factor value, subject to a maximus product of 1.x.10 °. These on this product, which is referred to the product. assign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Beter this value in Table 5-1.

5.2.3 Torquis. Brahmie the targets factory category for the nearby population threat based on two factors marrhy individual and population within a 1-mile travel distance from the site.

5.2.3.1 Nearby individual. If one or mor persons meet the section 5.1.3 criteria for a

resident individual, assign this factor a value of 0. Enter this value in Table 5-1.

If no person meets the criteria for a resident individual, determine the shortest travel distance from the site to any residence or school. In determining the travel distance, measure the shortest overland distance an individual would travel from a residence or school to the nearest area of observed contamination for the site with an attractiveness/accessibility factor value greater than 0. If there are no natural barriers to travel, measure the travel distance as the shortest straight-line distance from the residence or school to the area of observed contamination. If natural begriers exist ffor example, a river), measure the travel distance as the shortest straight-line distance from the residence or school to the nearest crossis point and from there as the shortest straight-line distance to the area of observed contamination. Based on the shortest travel distance, assign a value from Table 5-9 to the nearest individual factor. Enter this value in Table 5-1.

TABLE 5-9,--NEARBY INDIVIDUAL FACTOR VALUE:

Travel distance for nearby individual (miles)	Assigned velue
Greater than 0 to 1/4	1*

"Assign a value of 0 % one or more paraons meet the section 5.1.3 criteria for resident individual.

5.2.3.2 Population within 1 mile.

Determine the population within each travel distance catagory of Table 5-10. Count residents and students who attend school within this travel distance. Do not include those people already counted in the resident population threat. Determine travel distances as specified in section 5.2.3.1.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located. Based on the number of people included within a travel distance category, assign a distance-weighted population value for that travel distance from Table 5-10.

Calculate the value for the population within 1 mile factor (PN) as follows:

$$PN = \frac{1}{10} \frac{3}{10} W$$

where:

W. = Distance-weighted population value from Table 5-10 for travel distance category i.

If PN is less than 1, do not round it to the nearest integer; if PN is 1 or more, round to the nearest integer. Enter this value in Table 5-1.

5.2.3.2 Calculation of nearby population targets factor category value. Sum the values for the nearby individual factor and the population within 1 mile factor. Do not round this sum to the nearest integer. Assign this sum as the targets factor category value for the nearby population threat. Enter this value in Table 5-1.

TABLE 5-10.--DISTANCE-WEIGHTED POPULATION VALUES FOR NEARBY POPULATION THREAT*

9 9		Humber of people within the travel distance category										
Travel distance category (miles)	•	1 to 10	11 10 30	31 to 100	10T to 300	301 to 1,000	7:001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 .to 300,000	100,000 · od 000,000,1
Greater than 0 to 1/2 Greater than 3/4 to 1/4 Greater than 1/4 to 1/4	000	0.1 0.05 0.02	0.4 0.2 0.1	1.0 0.7 0.3	4 2 1	19 7 3	41 20 10	130 , 65 33	408 204 102	1,303 652 326	4,081 2,041 1,020	13,034 6,517 3,258

^{*}Round the munitier of people present within a travel distance category to nearest integer. Do not round the assigned detance-veighted population value to nearest integer.

5.2.4 Calculation of nearby population threat score. Multiply the values for likelihood of exposure, waste characteristics, and targets for the nearby population threat, and round the product to the nearest integer. Assign this product as the nearby population threat score. Enter this score in Table 5-1.

5.3 Calculation of soil exposure pathway score: Sum the resident population threat score and the nearby population threat score, and divide the sum by 82,500. Assign the resulting value, subject to a maximum of 100, as the soil exposure pathway score (S_p). Enter this score in Table 5-1.

6.0 Air Migration Pathway

Evaluate the air migration pathway based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 6-1 indicates the factors included within each factor category.

Determine the air migration pathway score (S_n) in terms of the factor category values as follows:

$$S_a = \frac{(LR)(WC)(T)}{SF}$$

where:

LR=Likelihood of release factor category value.

WC=Waste characteristics factor category value.

T=Targets factor category value. SF=Scaling factor.

Table 6-1 outlines the specific calculation, procedure.

SKLING COCE 6500-50-44

Targets (T)

Observed Release or Potential to Release

- · Cas Potential to Release
 - Gas Containment
 - Cas Source Type
 - Gas Migration Potential
- Particulate Potential to Release
- Particulate Containment
- Particulate Source Type
- Particulate
 Migration Potential

Toxicity/Mobility

- · Toxicity
 - Chronic
 - Carcinogenic
 - Acute '
- · Mobility

X

- · Gaseous Mobility
- Particulate Hobility

Hazardous Waste Quantity

- Hazardous Constituent Quantity
- Hazardous Wastestream Quantity
- Volume
- · Area

Mearest Individual Population

Resources

- · Level I Concentrations
- · Level II Concentrations
- · Potential Contamination

Sensitive Environments

- · Actual Contamination
- · Potential Contamination

BILLING CODE 8889-10-C

FIGURE 6-1 OVERVIEW OF AIR MIGRATION PATHWAY

TABLE 6-1.—AIR MIGRATION PATHWAY SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Likelihood of Release	1	i
1. Observed Release	550	ł
2. Potential to Release:]	
2a. Gas Potential to Release	500	}
2b. Particulate Potential to Release	500	<u> </u>
2c. Potertial to Release (higher of lines 2a and 2b)	<u>1</u> 500	1 —
3. Likelihood of Release (higher of lines 1 and 2c)	550	!
Waste Characteristics		!
4. Torichy/Mobilly	.] (4)	ł
5. Hezardous Waste Quantity	***	ł
6. Waste Characteristics	160	l -
Targata	1	1
7. Nearest Individual	.) 50	! —
8. Population:	1	1
Be Level i Concentrations	.j (e)	!
8b. Level II Concentrations	23 20 20 20 20	
8c. Potential Contamination	(b) ·	l
8d. Population (lines 8a+8b+8c)	(((! —
9. Resources	. 5	l —
10. Seneliive Environments	ł	ł
10a Actual Contemination	(c)	
10b. Potential Contentination	. (c)	
10c. Sensitive Environments (ince 10e+10b)	(0)] <u></u>
11. Targets fines 7+8d+9+10c)	(4)	
Ur Migration Pathway Score	1	
12. Pathwey Score (S.) [(lines 3×6×11)/82,500] 4	100.	

6.1 Likelihood of Release. Evaluate the likelihood of release factor category in terms of an observed release factor or a potential to nelease factor.

6.1.1 Observed release, Establish au observed release to the atmosphere by demonstrating that the site has released a hazardous substance to the atmosphere. Base stration on either:

· Direct observation—a material (for example, particulate matter) that contains one or more hexardous substances has been seen entering the atmosphere directly. When evidence supports the inference of a release of a material that contains one or more hazardous substances by the site to the etmosphere, demonstrated adverse effects accumulated with that release may be used

to establish an observed release. · Chemical analysis—an analysis of air samples indicates that the concentration of embient hezardous substance(s) has increased significantly above the background concentration for the site (see section 2.3).

Some portion of the significant increase must be attributable to the site to establish the observed release.

If an observed release can be established, assign an observed release factor value of 550, enter this value in Table 6-1, and proceed to section 6.1.3. If an observed release cannot be established, assign an observed release factor value of 0, enter this value ir. Table 6-1, and proceed to section

5.1.2 Potential to release. Evaluate potential to release only if an observed release cannot be established. Determine the potential to release factor value for the sit by separately evaluating the gas potential to release and the particulate potential to release for each source at the site. Select the highest potential to release value (either gas or particulate) calculated for the sources evaluated and assign that value as the site potential to release factor value as specified below.

6.1.2.1 Gas potential to release. Evaluate gas potential to release for those sources that contain gaseous hazardous substances—that is, those hazardous substances with a vapor pressure greater than or equal to 10^{-6} torr.

Evaluate gas potential to release for each source based on three factors: gas containment, gas source type, and gas migration potential. Calculate the gas potential to release value as illustrated in Table 6-2. Combine sources with similar characteristics into a single source in evaluating the gas potential to release factors.

TABLE 6-2.—GAS POTENTIAL TO RELEASE EVALUATION

Source	Source type *	Gas containment factor value b	Gas source type factor value ^c	Ges migration posential factor value ⁴	Sum	Gas source value
•		٨	В	c ·	(B+C)	A(B+C)
2		i		,		
3		<u> </u>			·	
4	<u> </u>) 				
5		<u>}</u>				
6	! 	<u> </u>			<u> </u>	
7	<u> </u>	ļ			<u> </u>	····
8		1			<u> </u>	

Gas Potentizi to Reliage Factor (Select the Highest Gas Source Value)

^{*} Maximum value applies to weste characteristics category.
* Maximum value not applicable.
*No specific maximum value applies to factor. However, pa
*Do not round to nearest integer. is to factor. However, pathway score based solely on sensitive environments is Smited to maximum of 60.

Enter a Source Type listed in Table 6-4.

Enter Gas Course rope Factor Value from section 6 12.1.1.

Enter Gas Source Type Factor Value from section 6.1.2.1.2.

Enter Gas Migration Potential Factor Value from section 6.1.2.1.5.

6.1.2.1.1 Gry containment Andyn e eusce a value from Table 6-1 for pan outsignant. Use the lowest value from ent Antiga oach Table 8-3 that ap, lies to the source, except: assign a value of 10 if there is evidence of

biogos release or if there is an active fire within the source.

TABLE 6-3.—GAS CONTABBILITY FACTOR VALUES

Gas consimunt description	Assigned value
All shading energy there specificity lated below	
Edition of Virgin reference	12:
One collection/beatment gratum functioning country' improved, emissional, and completely covering course	
Source extendedly companied by emphasing students and an other containment specifically described in this table applies	7
Uncertainted self-out >3 feet	
• Sum edutadly rejeted 4th file report of	
Summ liftly regulated with much expected and	;
Uncertainfield gall diver \$1 feet and \$3 feet.	· 1
- Some heady regressed with connellably no expensed self	
-Cour sell tips and quicket to our relevation's or relevant	
Stores submittely regarded with filte deposed sell and cover sell type resistant to gas migration?	7
Chapeteninglad and open <1 feet	
Shorts heady registed with consolidly no exposed and and cover sell type resistant to gas relyculon	7
Tendy or partially anchored within structurally intext building and no other concurrement specifically described in this table applies	7
Source contain soluty of intest, posted containing: • Tablic posteriori from wayther by regularly important, registational cover	
• Other	

6.1.2.1.2 Gas.cource type. Assign a value for gain strains type to each cource on fallows:

• Determine of the cource mosts the

- Detrusine if the source mosts the definion size sequinations based on the source humalism wests quantly value (our section 24215). If the poster receives a humbers waste quality when s n, consider the source to meet the
- dalaram she requirement. If the reques mosts the minis word, ensign it a value from Table 8-4 for gas street type.
- If the source door not meet the minimum ire requirement, design it a value of 0 for gas steers file

If no source of the site mosts the minimum size regularizati, analys each source of the site a value from Table 6-4 for you source

TABLE 6-4.—Source Type Factor VALUES

	Assignment		
Source type	Gas	*	
Active the plan	14	22	
grand; • Eddures el tingas relegas	73	22	
 No existence of biogen release Curtaintees or tasks, not observance 	. 11	22	
specified. Contaminated self-(excluding lead	. 25	14	
Destroit.		22	
Landon/leid Instruct	. 29	22	

TABLE 8-4.—Sounce Type Factor VALUES—Concluded

	**		
Strate Abo	G	\$1	
Landit: • Evidence of blogas release • No evidence of blogas release Plac	39 11	**	
Tulings pile Scopp motel or junk pile Tunch pile Chamical wants pile Other wants pile		17	
Surface Impoundments (corlect backfles): - Endance of blogas release	. 33	n	
topiding: • Dry	19	22 •	
where specified	. •	•	

6.1.2.1.3 Gas axigration potential. Bulluste this factor for each source as follows:

- Assign a value for gas migration potential to each of the goscous hazardous substances associated with the source (see section 2.2.2) as follows:
 - -Assign values from Table 8-5 for vaper pressure and Henry's constant to each bazardous substance. If Henry's constant cannot be determined for a hezardous substance, assign that hazardous substance a value of 2 for the Henry's constant component.
 - -Sum the two values assigned to the bazardous substance.

- -Based on this sum, seeign the hazardous substance a volve from Table 0-6 for gas migration potential. Assign a volve for gas migration stantial to each source as follows:
- - -Solect three hemoteus enbetances
 esociated with the source:
 --E more than three passeus hexacious
 substances can be associated with
 the source, solect three that have
 the highest gas migration potential
 - Figure than three gaverus hassarium substances can be assaciated with a source, select all -- Fi
 - -Average the gas migration potential values assigned to the selected homodous substances.
 - -Based on this overage value, essign the searce a gas magnition potential value from Table 9-7.

TABLE 6-5.--VALUES FOR VAPOR PRESSURE AND HENRY'S CONSTANT

Vapor protocos (Fort)	Assigned Value
Greater than 18	3 2 1 0

Plantry's constant (atm-m*/mel)	Assigned
Greater than 18" 2	3
Greater than 18" by 10" 3	2
18" to 10" 5	1
Lest than 10" 7	0

^{*}This value must be used if applicable.

*Consider resist the grained and unknown grained scale resistant to gas migration. Consider all other soils materialists.

TABLE 6-6.—GAS MIGRATION POTENTIAL VALUES FOR A HAZARDOUS SUBSTANCE

Sum of values for vapor pressure and Henry's constant	Assigned value
0	0
1 or 2	6
3 cr 4	11
5 cr 6	17

TABLE 6-7.—GAS MIGRATION POTENTIAL VALUES FOR THE SOURCE

Average of gas migration potential values for three hidzardous substances *	Assigned eulev
0 to < 3	0 6

TABLE 6-7.-GAS MIGRATION POTENTIAL VALUES FOR THE SOURCE--Concluded

Average of gas migration potential values for three hazardous aubstances *	Assigned value
8 to < 14	11 17

6.1.2.1.A Calculation of gas potential to release value. Determine the gas potential to release value for each source as illustrated in Table 6-2. For each source, sum the gas source type factor value and gas migration potential factor value and multiply this sum by the gas containment factor value. Select the highest product calculated for the sources evaluated and assign it as the gas potential to release value for the site. Enter this value in Table 6-1.

6.1.2.2 Particulate potential to release. Evaluate particulate potential to release for those sources that contain particulate hazardous substances—that is, those hazardous substances with a vapor pressure less than or equal to 10⁻¹ torr.

Evaluate particulate potential to release for each source based on three factors: particulate containment, particulate source type, and particulate migration potential. Calculate the particulate potential to release value as illustrated in Table 6-8. Combine sources with similar characteristics into a single source in evaluating the particulate potential to release factors.

8.1.2.2.1 Particulate containment. Assign each source a value from Table 6-0 for particulate containment. Use the lowest value from Table 6-8 that applies to the source.

6.1.2.2. Particulate source type. Assign a value for particulate source type to each source in the same manner as specified for gas sources in section 6.1.2.1.2.

8.1.2.2.3 Particulate migration potential. Based on the site location, assign a value from Pieure 6-2 for particulate migration potential. Assign this same value to each source at the site.

TABLE 6-8.—PARTICULATE POTENTIAL TO RELEASE EVALUATION

Source	Source type *	Particulate containment factor value	Particulate type factor value *	Particulate migration potential factor value ⁴	Sum	Particulate source value
		A	8	С	(B+C)	A (B+C)
)		· · · · · · · · · · · · · · · · · · ·				
					· ·	
· .						<u> </u>
<u>. </u>						<u>t</u>
· ·						<u> </u>
						<u> </u>
	Particulate Dotter	diet to Delagon Factor	Volumi Calant Limbout	Particulate Source Va		

Value from section 6.1.2.2.1. Value from section 6.1.2.2.2. Factor Value from section 6.1.2.2.3.

TABLE 6-9.—PARTICULATE CONTAINMENT FACTOR VALUES

Particulate containment description	Assigner value
A situations except those specifically listed below	10
ource contains only particulate hazandous substances totally covered by liquids	
curce substantially surrounded by engineered windursek and no other containment specifically described in this table senties	7
curce covered with essentially impermeable, regularly inspected, maintained cover	0
contaminated soil cover > 3 feet:	ľ
Source substantially vegetated with little or no exposed soil	
Source lightly vegetated with much exposed soil	3
Source substantially devoid of vegetation	
Incontaminated soil cover > 1 foot and < 3 feet:	l l
Source heavily regulated with essentially no exposed soit:	•
—Cover soil type resistant to gas migration *	
Cover soil type not resistant to ges migration * or unknown	
Source substantially vegetated with little exposed soil and cover soil type resistant to gas migration	7
• Other	10
Incontaminated soil cover < 1 foot	1 _
Source heavily vegetated with essentially no exposed soil and cover soil type resistant to gas migration's	7
• Other	10
otally or partially enclosed within-structurally intact building and no other containment specifically described in this table applies	
ource consists solely of containers:	
All containers contain only liquids	0
All containers intact, sealed, and totally protected from weather by regularly inspected, maintained cover	0
All containers intact and sealed	3
• Other	10

^{*} Consider moist fine-grained and saturated coarse-grained soils resistant to gas migration. Consider all other soils nonresistant.

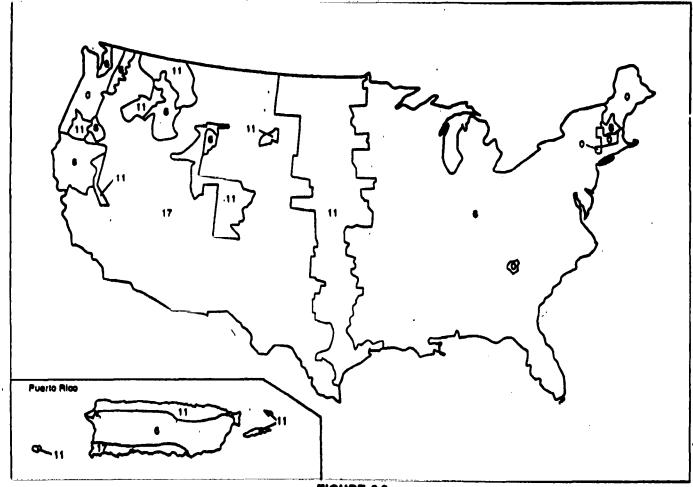


FIGURE 6-2
PARTICULATE MIGRATION POTENTIAL FACTOR VALUES

BILLING CODE 6540-50-C

FIGURE 6-2.—PARTICULATE MIGRATION POTENTIAL FACTOR VALUES—CONCLUDED

Location	Particulate migration potential assigned value
Hawaiian Islands	
Hile Henry	0
Honolulu, Oahu	17
Kahului Maui	17
Lenei	17
Limie, Kausi	11
Molekai	17
Pacific Islands Guarte	6
Johnston Island	17
Koror Island	0
Kwaialein Island	6
Mainten Marchall Islands	0
Pago Pago, American Samoa	0
Ponepe Island	0
Truk, Caroline Islands	0
Wake Island	17
Yap Island	0
Alaska	i
Anchorage	17
	0
Sarrow Sarter Island	17 17
Elethet	17
Elizabet a a	17
Big Delta	17
Cold Bay	6
Fairbanks	17
Guillana	17
Homer	11
J. Meau	0
King Salmon	11
Kodiak Kutxebue	0 17
Kutzebue	17
Nome	- 11
St. Paul Island	11
Talkestne	6
Unalakinet	17
Valdez	Ö
Yaiostat	0
American Virgin Islands	
St. Croix	17
St. John	71
St. Thomas	11
Puerto Rico	
Areabo	- 6 6
Coloso	11
Humacap	6
Isabela Station	11
Ponce	17
San Juan	11

For site locations not on Figure 6-2, and for aite locations near the boundary points on Figure 6-2, assign a value as follows. First, calculate a Thornthwaite P-E index using the following equation:

$$PE = \sum_{i=1}^{12} 115 \left[P_i / (T_i - 10) \right]^{10/9}$$

wuete

PE=Thornthwaite P-E index.

P. = Mean monthly precipitation for month i, in inches.

T.= Mean monthly temperature for month i, in degrees Fahrenheit; for any month having a mean monthly temperature less than 22.4 T, use 28.4 T.

Based on the calculated Thornthwaite P-E index, assign a source particulate migration potential value to the site from Table 8-10. Assign this same value to each source at the site.

TABLE 6-10.—PARTICULATE MIGRATION POTENTIAL VALUES

Thomshwalte P-E Index	Assigned value
Greater than 150	0 6 11 17

6.1.2.2.4 Calculation of particulate potential to release value. Determine the particulate potential to release value for each source as illustrated in Table 6-8. For each source, sum its particulate source type factor value and particulate migration potential factor value and multiply this sum by its particulate containment factor value. Select the highest product calculated for the sources evaluated and assign it as the particulate potential to release value for the site. Enter the value in Table 8-1.

6.1.2.3 Calculation of potential to release factor value for the site. Select the higher of the gas potential to release value assigned in section 6.1.2.1.4 and the particulate potential to release value assigned in section 6.1.2.2.4. Assign the value selected as the site potential to release factor value. Enter this value in Table 6-1.

6.1.3 Calculation of likelihood of release factor category value. If an observed release is established, assign the observed release factor value of 550 as the likelihood of release factor category value. Otherwise, assign the site potential to release factor value as the likelihood of release factor category value. Enter the value in Table 6-1.

8.2 Waste characteristics. Evaluate the waste characteristics factor category based on two factors: toxicity/mobility and hazardous waste quantity. Evaluate only those hazardous substances available to migrate from the sources at the site to the atmosphere. Such hazardous substances include:

Flazardous guinteness that meet the criteria fit in elleristed relinion to the atmosphere.

 All gassous hazardous substances associated with a source that has a gas containment factor value greater than 0 (see section 2.2.2, 2.2.3, and 6.1.2.1.1).

 All particulate hazardous substances associated with a source that has a particulate containment factor value greater than 0 (see section 2.2.2, 2.2.3, and 6.1.2.2.1).

6.2.1 Toxicity/mobility. For each hazardous substance, assign a toxicity factor value, and a combined toxicity/mobility factor value as specified below. Select the toxicity/mobility factor value for the air migration pathway as specified in section 6.2.3.3.

8.2.1.1 Toxicity. Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

6.2.1.2. Mobility. Assign a mobility factor value to each hazardous substance as follows:

Gaseous hazardous substance.

-Assign a mobility factor value of 1 to each gaseous hazardous substance that meets the criteria for an observed release to the atmosphere.

-Assign a mobility factor value from Table 6-11, based on vapor pressure, to each gaseous hazardous substance that does not meet the criteria for an observed release.

Particulate hazardous substance.

-Assign a mobility factor value of 0.02 to each perticulate hazardous substance that meets the criteria for an observed release to the atmosphere.

-Assign a mobility factor value from Figure 6-3, based on the site's location, to each particulate hazardous substance that does not meet the criteria for an observed release. (Assign all such particulate hazardous substances this same value.)

-For site locations not on Figure 6-3 and for site locations near the boundary points on Figure 6-3, assign a mobility factor value to each particulate hazardous substance that does not meet the criteria for an observed release as follows:

-Calculate a value M:

M=0.0182 (U³/[PE]²) where:

U=Mean average annual wind speed (meters per second). PE=Thoruthwaite P-E index from section 6.1.2.2.3.

 Based on the value M, assign a mobility factor value from Table 8-12 to each particulate hazardous substance.

Gaseous and particulate bazardous substances.

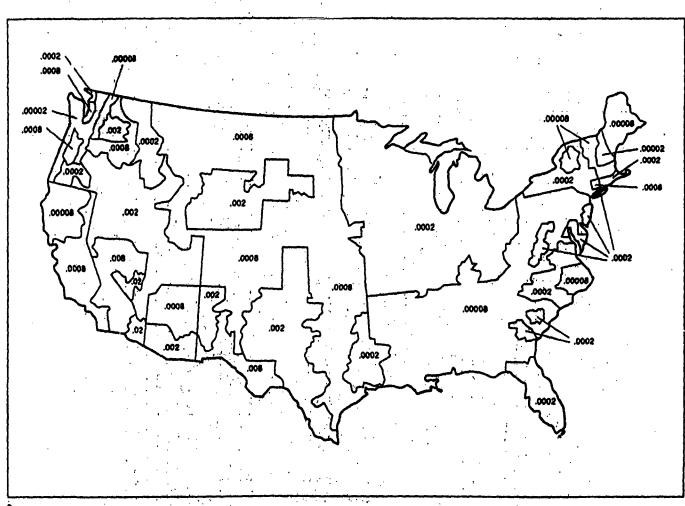
-For a bazardous substance potentially present in both gaseous and particulate forms, select the higher of the factor values for gas mobility and particulate mobility for that substance and assign that value as the mobility factor value for the hazardous substance.

6.2.1.3 Calculation of toxicity/mobility factor value. Assign each hazardous substance a toxicity/mobility factor value from Table 8-13, based on the values assigned to the bazardous substance for the toxicity and mobility factors. Use the hazardous substance with the highest toxicity/mobility factor value to assign value to the toxicity/mobility factor for the air migration pathway. Enter this value in Table 8-1.

\$1666 Federal Register / Vol. 55. No. 261, / Priday, December 14, 1800 / Rules and Regulations

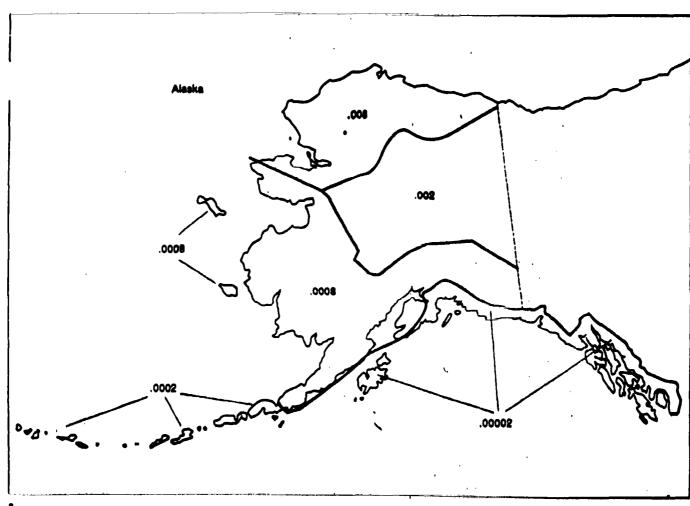
TABLE 6-11 GAS MOBILITY VALUES	FACTOR	TABLE 6-11.— AS MOBILITY VALUES—Concluded	*Do not round to exprest integer.	
Water pressure (Tors)	Assigned with:	Vapor pressure (Ton)	Assigned What:	
Greater than 16" Greater than 16" to 16"	19	Greater than 10 ⁻² to 10 ⁻³	0.002	





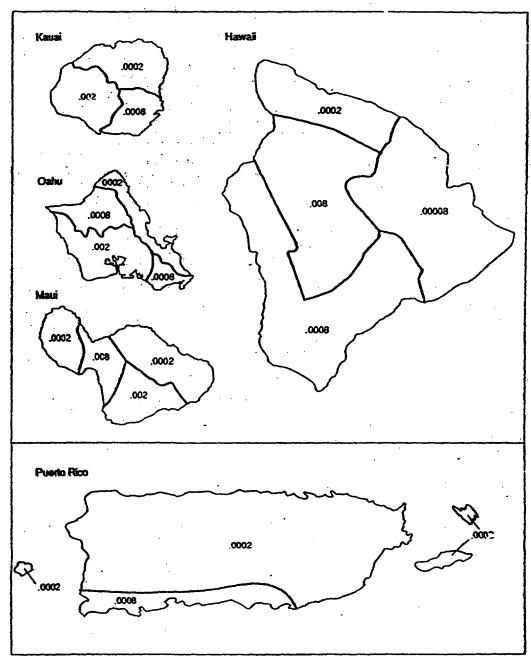
² Do not round to nearest integer.

FIGURE 6-3
PARTICULATE MOBILITY FACTOR VALUES*



⁸ Do not round to nearest integer,

FIGURE 6-3
PARTICULATE MOBILITY FACTOR VALUES*
(CONTINUED)



[®]Do not round to nearest integer.

FIGURE 6-3
PARTICULATE MOBILITY FACTOR VALUES*
(CONTINUED)

BILLING CODE 6580-50-6

FIGURE 6-3.PARTICULATE MOSILITY FACTOR VALUES—CONTRILIED

Lacotion	
Pucific Intends Coom	0,0002 9,000,0

FIGURE 6-3.—PARTICULATE MOBILITY FACTOR VALL S—CONCLUDED

Lecution	Performant metally metally return value
American Virgin Islands St. Croix St. John St. Thomas	0.0002

TABLE 6-12.—PARTICULATE MOBILITY FACTOR VALUES

M	Assigned value *
Greater than 1.4 × 10 ⁻²	0.02
14 × 10** Greater than 1.4 × 10**ba	0.000
14 x 18"1	0.6008
Greater Spec S.J. x 10**25	6.0002
1.4 x 10"1	6.00000 6.000002

^{*} Do not mand to compact integer.

TABLE 8-13.-TOMCTTY/MOBILITY FACTOR VALUES *

		Toxicity factor value									
- Michilly factor value	10,000	1,000	140	10	1						
	10,000	1000	100	-	,						
	2,000	200	7	2	9.2						
		7	i	148	0.000						
<u> </u>		2	- 82	9.00	0.002						
		8.2	0.02	9.002	0.0002						
		905	8.802	0.0002	0.00005						

^{*} Do not round to recreat integer.

6.22 Houndour visate quantity. Assign a basedour waste quantity factor value for the air migration pathway as specified in section 2.4.2. Enter this value in Table 6-1. 6.2.3 Calculation of waste characteristics

6.2.3 Colculation of waste characteristics factor congary value. Multiply the tenjoity/
multity factor volps and the homolous waste quantity factor value, subject to a maximum product of 1 × 19°. Based on this product, assign a value from Table 2-7 (motion 24.3.1) to the waste characteristics factor category. Bater this value in Table 6-1.

graces 2.4.1.1 to un week conservations of factor category. Buter this value in Table 6-1.

4.3 Targets.

Brelante the targets factor category based on four factors: assesset individual, population, resources, and sensitive environments. Include only those targets (for example, individuals, assestive environments) located within the 4-mile target distance limit, except if an observed release in established beyond the 4-mile target distance limit, include those additional targets that are opecified below in this section and in section 6.3.4.

Evaluate the asserunt individual and population factors based on whether the target populations are subject to Level! concentrations. Level II concentrations, or patential contembation. Determine which applies to a target population as follows.

If no samples meet the criteria for an observed release to air and if there is no observed release by direct observation, consider the entire population within the t-mile target distance limit to be subject to potential contamination.

If one or more samples most the criterio for an observed release to air or if there is an observed release by direct observation, evaluate the population as follows:

evaluete the population as follows:

Determine the most distant comple leastion that meets the criestia for Level I concentrations as specified in sections 2.5.2 and 2.5.2 and the most distant location (that is, sample leastion or direct observation leastion) that mosts the criteria for Level II concentrations. Use the health-based benchmarks from Table 9-14-is determining the level of contemplation for sample leasting. If the most distant Level II location is closer to a source than the most distant Level I sample lecation, do not consider the Level II location.

 Determine the single most distant location (sample location or direct observation location) that queets the criteria for Level I or Level II concentrations.

 If this single most distant location is within the 4-mile target distance limit, identify the distance categories from Table 8-25 in which the selected Level I concentrations sample and Level II concentrations sample (or direct observation location) are located:

 Consider the target population anywhere within this furthest Level I distance category, or anywhere within a distance category closer to a source at the site, as subject to Level I concentrations.

-Consider the target population located beyond any Level I distance categories, up to and including the population unywhere within the farchest Level II distance category, as subject to Level II concentrations.

Consider the remainder of the target population within the 4-mile target distance limit as subject to potential

 If the single most distant location is beyond the 4-mile treget distance limit, identify the distance at which the selected Level I concentrations sample and Level II concentrations sample (or direct observation location) are located:

—If the Level I sample location is within the 4-mile target distance limit, identify the target population subject to Level I concentrations as specified above.

-If the Level I sample location is beyond the 4-sale target distance limit, consider the target population located anywhere within a distance from the courses at the site equal to the distance to this sample location to be subject to Level I concentrations and include them in the evaluation.

Counider the target population located beyond the Level I target population, but located anywhere within a distance from the sources at the site oqual to the distance to the selected Level II location, to be subject to Level II concentrations and include them in the evaluation. Do not include any target population as subject to potential contamination.

TABLE 6-14.—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN AIR

- Concentration corresponding to National Ambient Air Quality Standard (NAAQS).
- Concentration corresponding to National Emission Standards for Hazardous Air Pollutants (NESHAPs).
- Screening concentration for cancer corresponding to that concentration that corresponds to the 20⁻⁶ individual cancer risk for inhalation proposes.
- Screening concentration for noncencer toxicological responses corresponding to the Reference Dose (RfD) for inhabition exposures.

TABLE 6-15.—Air Migration Pathway
Distance Weights

Distance category (miles)	Assigned distance weight*
Guester than 0 to 14. Greater than 15 to 15. Greater than 15 to 1. Greater than 1 to 2. Greater than 2 to 3. Greater than 3 to 4. Greater than 4.	1.0 0.25 0.054 0.046 0.0051 0.0023 0.0014

^{*} Do not round to meanest integer.

- 6.3.1 Nearest individual. Assign the nearest individual factor a value as follows:
- If one or more residences or regularly occupied buildings or areas is subject to Level I concentrations as specified in section 6.3, assign a value of 50.
- If not, but if one or more a residences or regularly occupied buildings or areas is subject to Level II concentrations, assign a value of 45.
- If none of the residences and regularly occupied buildings and areas is subject to Level I or Level II concentrations, assign a value to this factor based on the shortest

distance to any residence or regularly occupied building or area, as measured from any source at the site with an air migration containment factor value greater than 6. Based on this shortest distance, assign a value from Table 6-16 to the nearest individual factor.

Enter the value assigned in Table 6-1.

TABLE 6-16.—NEAREST INDIVIDUAL FACTOR VALUES

Distance to nearest individual (miles)	Assigned value
Level 1 concentrations *	50 45
Greater than 14 to 14.	20 7 2
Greater than ½ to 1	1 0

^{*} Distance does not apply.

6.3.2 Population. In evaluating the population factor, count residents, students, and workers regularly present within the target distance limit. Do not count transient populations such as contomers and travelers passing through the area.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

6.3.2.1 Level of contamination. Evaluate the population factor based on three factors: Level I concentrations, Level II

concentrations, and potential contamination.

Evaluate the population subject to Level I concentrations (see section 6.3) as specified in section 6.3.2.2, the population subject to Level II concentrations as specified in section 6.3.2.3, and the population subject to potential contamination as specified in section 6.3.2.4.

For the potential contamination factor, are population ranges in evaluating the factor as specified in section 6.3.2.4. For the Level I and Level II concentrations factors, see the population estimate, not population ranges, in evaluation both factors.

evaluating both factors.
63.2.2 Lovel I concentrations. Sum the number of people subject to Level I

concentrations. Multiply this sum by 10. Assign the product as the value for this factor. Enter this value in Table 6-1.

6.3.23 Level II concentrations. Sum the number of people subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 6-1.

6.3.2.A Potential contamination.

Determine the number of people within each distance category of the target distance limit (see Table 8-15) who are subject to potential contamination. Do not include those people already counted under the Level I and Level II concentrations factors.

Based on the number of people present within a distance category, assign a distance weighted population value for that distance category from Table 8-17. (Note that the distance-weighted population values in Table 6-17 incorporate the distance weights from Table 8-15. Do not multiply the values from Table 6-17 by these distance weights.)

Calculate the potential contamination factor value (PI) as follows:

$$PI = \frac{1}{10} \sum_{i=1}^{n} W_i$$

vhere:

W_i=Distance-weighted population from Table 8-17 for distance category i. n=Number of distance categories.

If PI is less than 1, do not round it to the nearest integer; if PI is 1 or more, round to the nearest integer. Enter this value in Table 6-1.

6.3.2.5 Calculation of population factor value. Som the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value. Enter this value in Table 6-1.

Table 6-17.—Distance-Weighted Population Values For Potential Contamination Factor for Air Pathway*

	Number of people within the distance category												
Distance category (miliai)	. 0	1 to 10	11 to 30	31 to 100	101 10 300	301 to 1,000	1,001 30 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 80 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000
On a source Greater than 0 to 1/4 Greater than 1/4 to 1/4 Greater than 1/4 to 1 Greater than 1 to 2 Greater than 2 to 3 Greater than 3 to 4	0000000	4 1 0.2 0.06 0.02 0.009 0.005	17 4 0.9 0.3 0.09 0.04 0.02	53 13 3 0.9 0.3 0.1 0.07	164 41 9 3 0.8 0.4 0.2	522 131 26 8 3 1	1,833 406 88 26 8 4	5,214 1,304 282 83 27 12 7	16,325 4,081 862 251 63 36 23	52,137 13,034 2,815 834 266 120 73	163.246 40,812 8,815 2,612 833 375 229	521,360 130,340 28,153 8,342 2,659 1,199 730	1,632,455 408,114 88,153 26,119 8,326 3,755 2,285

^{*}Round the number of people present within a distance category to nearest integer. Do not round the assigned distance-weighted population value to nearest integer.

6. 3 Resources. Evaluate the resources factor as follows:

 Assign a value of 5 if one or more of the following resources are present within one-

half mile of a source at the site having an air

of containment factor, value granter 28

mandal spicult. mandal shicult

-Major er designated increation are • Assign a value di O if note of these

restruces in present.

Sinter the value confused in Table 6-1.

4.14 Annalise continuents: Brainste suntilles authorates haved at two factors: actual contemination and potential contentanteston. Detaining which factor آبا ب سار

no complex most the criteria for on erved referent to air seed if there is no ž m s of release to air year is wave to the of release by direct observation. or all resulting authorization located, by ar which, which the target distance.

d spinose by direct observation. no the most distant location (that is, aved sub location or direct observation a) that mosts the criteria for an علم آن

- If the most distant bending mostley the distin for an observed release is within the anis.imput diptaces limit, identify the nce category from Table 6-25 in which it
 - Consider sanctive correspondent Tocated, partially or whelly, anywh within this distance category or anywhere within a distance category return while a distance entagery are to a source at the site or enbject
- to extent contamination.

 Consider all other agentive
 environments become, perfectly or
 whally, within the target distance limit
 as subject to potential contamination.

 If the most distant location mosting the
 crimin for an observed spinors is beyond the
- 4-mile terget distance Built, identify t nce at which it is leasted:
 - -Consider sensitive environments located, partially or whelly, enjohese within a distance from the sources at the olse equal to the distance to this location to be subject to actual contemporary and include all each consider environments in the
 - Do not include any consistive environments as subject to potential

6.3.4d Actual contamination. Determines a sensitive acrietosants subject to cond contemination (i.e., those located entially or wholly within a distance cost object to actual contemination). Assign not cate value(a) Train Table 4-23 (section 6.1.4.3.1.1) to each sensitive environment exhibit to mailire que and embject to •

ected contemination.

For those condition conteminate that are well-and; noting an additional value from Table 6-10. In assigning a value from Table 6-10, include only those partitions of verticals incuted within distance contempories subject to actual contempories. If a western is increased. partially in a distance category subject to actual contomination and partially in one subject to potential contr iotion, then usicly for purposes of Table 6-18. Count the parties in the distance category subject to parential contamination under the potential

contamination factor in section 6.3.4.2.
Determine the total accease of wetlands within those distance categories subject to actual contemination and narige a value from Table 8-18 based on this total acreage.

Calculate the actual contamination factor value (EA) as follows:

- Value assigned from Table 6-18 for wellands in distance categories subject to actual continuisation. WA-Value and

- S₁= Value(s) assigned from Table 4-23 to sensitive assignment i.
- n = Number of sensitive environments subject to actual contamination. Ester the value assigned in Table 6-1.

TABLE 6-18.-WETLANDS RATING VALUES FOR AIR MIGRATION PATHWAY .

Wideled area (screet)	Assigned		
Less than 1	*		
Greater than 50 to 160	75 125 175		
Greater than 200 to 200	250 250 450		
Grant for 501	500		

[&]quot;Wollands as defined in 40 CFR section 2003.

83A2 Potential contr Detarmine those sensitive conviruements lecated, partially or wholly, within the target distance limit that are subject to potential customination. Assign value(s) from Table 4-23 to each sensitive environment subject to potential contemplation. Do not include ree sensitive environments already counted

for Table 4-23 water the arrest contemination factor.

For each distance category subject to potential contemination, onto the value(s) essigned from Table 4-23 to the assertive consents in that distance category. If a ultive environment is located in more than one distance category, easign the reactive environment only to that distance category having the highest distance weighting value from Table #-15.

For those sensitive environments that are fands, ensign en additional value fro Table 6-18. In com ning a value from Table 6-18, include only those portions of wetlands located within di tance categories subject to potential contumination, as specified in section 6.3.4.1. Treat the wetlands in each uce calegary as separate nitive environments solely for purposes of applying Table 6-18. Determin screnge of wetlands within each of these distance categories and assign a separate value from Table 6-18 for each distance

stegory. Calculate the potential contamination factor value (EP) on follows:

$$EP = \frac{1}{m} \sum_{j=1}^{m} (W_j + S_j D_j)$$

Where

S_o=Value(e) assigned from Table 4-23 to agnative assistanted in distance

category j. n=Hunber of sequitive confusements subject to potential contemination.

W₁—Value conjunct from Table 6-38 for walked over in distance category j. D₁—Distance weight from Table 6-15 for distance category j.

distance category j.

m=Number of distance categories subject to patential contumination.

If IP is less than 1, do not round it to the easest integer; if EP is 1 or more, round to se measest integer. Buter the value assigned in Table 0-1.

6.3.4.3 Calculation of pensitive cavirogments factor value. Sun the factor values for actual contamination and potential contemination. Do not round this sum, designated as EM, to the measust integer.

Because the patterny score based solely on ments is limited to a meximum of 60, use the value 20 to determine the value for the sensitive covinguages factor as follows:

- · Multiply the values assigned to Mailhood of inhous (LR), weste characteristics (WC), and EB. Divide the product by \$2.50
 - -If the result is 60 or less, essign the the M as the sensitive environments factor value.
 - -If the result exceeds 60, calculate a value BC as follows:

Assign the value BC on the sensiti wissements factor value. Do not round this value to the nearest interer. Buter the value assigned for the sensitive

ents factor in Table 6-1.

8.2.5 Colculation of largest factor conguery value. Sum the nearest individual, population, resources, and sensitive cuvingaments factor values. Do not round this sum to the measuret integer. Assign this sum as the targets factor cotagory value. Eater this value in Table 6-1.

6.4 . Calculation of air migration pothway score. Multiply the values for likelihood of release, wests characteristics, and targets. and tound the product to the nearest integer. Then divide by \$2,500. Assign the resulting value, subject to a maximum value of 100, as the air migration pathway score [S_a]. Enter this score in Table 8-1.

7.0 Sites Containing Radioactive dances

In general, radioactive substances are hazardous substances under CERCLA and should be considered in HRS scoring. Releases of certain radioactive substances are, however, excluded from the definition of "release" in section 101(22) of CERCLA, as amended, and should not be considered in HRS sporing.

Evaluate sites containing radioactive substances using the instructions specific sections 2 through 6, supplemented by the instructions in this section. Those factors

denoted with a "yes" in Table 7-1 are evaluated differently for sites containing radioactive substances than for sites containing only normadicactive hazardous substances, while those denoted with a "no" are not evaluated differently and are not addressed in this section.

TABLE 7-1.--HRS FACTORS EVALUATED DIFFERENTLY FOR RADIONUCLIDES

Ground water pathway	Status *	Surface water pathway	States.	Soil exposure pathway	Status .	Air pathway	Status *
Likelihood of Release		Litrollhood of Rolesco		Likelihood of Exposure		Likelihood of Release	
Observed Release	. Yes	Cheeved Release	Yes	Observed Contembration	Yes	Channel Raisese	Yes
Potential to Release	No	Potential to Release,	No	Attractiveness/Accessibility	· No	Gas Potential to Release	No
Containment	No	Overland Flow Contain-	. No	to Nearby Residents	. '	Gas Containment	No
Not Precipitation	. No	ment. Runoff	No	Area of Contemination	No		٠
Depth to Aquiler	No	Distance to Surface Water	No.	Area or Consumeration	740	Gas Source Type	No No
Travel Time	No	Flood Frequency	No	•		Particulate Potential to	No
	'	Flood Containment	No			Release	
	1			ł ,	'	Particulate Containment	No
			1			Perticulate Source Type	No
						Particulate Migration Po- tential.	No
Waste Characteristics	ł	Waste Characteristics	1	Waste Characteristics		Waste Characteristics	
Toxicity	Yes	Toxicity/Ecotoxicity	Yes/ Yes	Toxicity	Yes	Toxicity	Yes
Mobility	No	Persistance/Mobility:	Yes/No	Hezardous Waste Quantity	Yes	Mobility	No
Hazardous Waste Quantity	Yes	Bioaccumulation Potential	No			Hazardous Waste Quantity	Yes
·		Hezardous Waste Quantity	Yes		•	•	
Targets .		Targets		Targets		Targets	
Nearest Well	Yes	Negrest Intake	Yes	Resident Individual	Yes	Newest Individual	Yes
Papulation	Yes	Drinking Water Population	Yes	Resident Population	Yes	Population	Yes*
Wellhood Projection Area	No No	Resources	No Yes	Workers	No	Resources	No
THE PROPERTY AND A	mo .	Husen Food Chain Individ-	Yes	Resources	No No	Sentence Exteronments	No
		und	- بعا	ments.	140		
•		Human Food Chain Popula-	Yes *				
	1		ł	Negrby Individual	No		
•	l		l	Population Within 1 Mile	No		

"Factors evaluated differently are denoted by "yes"; factors not evaluated differently are denoted by "no."

Difference is in the determination of Level I and Level II concentrations.

In general, sites containing mixed radioactive and other bazardous substances involve more evaluation than sites containing only radionuclides. For sites containing mixed radioactive and other hazardor substances, HRS factors are evaluated based on considerations of both the radioactive substances and the other hazardous substances in order to derive a single set of factor values for each factor category in each of the four pathways. Thus, th., HRS score for these sites reflects the combined potential hazards posed by both the radioactive and other hazardous substance

Section 7 is organized by factor category. similar to sections 3 through 6. Pathway-specific differences in evaluation criteria are specified under each factor category, as appropriate. These differences apply largely to the soil exposure pathway and to sites containing mixed radioactive and other hazardous substances. All evaluation criteria specified in sections 2 through 6 must be met, except where modified in section 7.

7.1 Likelihood of release/likelihood of exposure. Evaluate likelihood of release for the three migration pathways and likelihood of exposure for the soil exposure pathway as specified in sections 2 through 6, except: establish an observed release and observed entamination as specified in section 7.1.1. When an observed release cannot be established for a migration pathway, evalu potential to release as specified in section 7.1.2. When observed contamination car be established, do not evaluate the soil

exposure pathway.
7.1.1 Observed release/observed contamination. For redioactive substances, establish an observed release for each migration pathway by demonstrating that the site has released a radioactive substance to the pathway (or watershed or aquifer, as appropriate); establish observed contamination for the soil exposure pathway as indicated below. Base these demonstrations on one or more of the following. as appropriate to the pathway being evaluated:

Direct observation:

-For each migration pathway, a material that contains one or more radionuclides has been seen entering the atmosphere, surface water, or ground water, as appropriate, or is known to have entered ground water

or surface water through direct deposition, or

For the surface water migration pathway, a source area containing radioactive substances has been flooded at a time that radioactive substances were present and one or more radioactive substances were in contact with the flood waters.

 Analysis of radionuclide concentrations in samples appropriate to the pathway (that is, ground water, soil, air, surface water, benthic, or sediment samples):

-For radiomuclides that occur naturally and for radionuclides that are ubiquitous in the environment:

-- Measured concentration (in units of activity, for example, pCi per kilogram [pCi/kg], pCi per liter [pCl/1], pCi per cubic meter [pCi/ m)) of a given radionuclide in the sample are at a level that:

---Equals or exceeds a value 2 standard deviations above the mean site-specific background concentration for that

socionaciide in that type of

secuple, or Deceads the upper limit valu e range of regional legerand concentration ďi for that specific sclide in that type of

ome portion of the increase must be attributable to the site to establish the observed subsect (or observed

Dur the cell exposure peteroy only, the cell-annuality most also be propert at the explane or covered by 2 flui or less of cover material flor example, pully in establish observe control of the cell-list observe ردا است

scheround concentrations

- controller for write of excessor constitution to that of activity) of a given to incominde in a sample equality or cannot be a sample equality in limit for that specific to illustration in that type of make and is officientable to the
- n, if the main cascastration agents or consols sample quantitation limb, but in salenge can also be attributed to one or muse unighboring eller. Sum the measured concentration of that reflectife mut also equi er exceed a value either 2 standard derical a very the seas designation of that redisposities Advised by these anightering oline or 3 times its background concentration, whichever is lower.

-contestion, whichever is seen.

--If the sample quantitation limit count be established:

---If the sample analysis was participand under the EPA Contest Laboratory Programment Agents and the EPA Contest Laboratory Programment Agents and the EPA contest Agents and the EPA contest A un de EA a m limit (CRQL) m lace of the sample reference for o

> E the recepts unch a way resupper chalps in it is not performed under the SPA Contract Laborary Program, way the detection limit in whether of the contraction is not the contraction in its second احد نا ن er of the same رًا جباد

For the sell expense pathway only, the self-markle most also be present at the surface or covered by 2 first or less of cover material flur example, sully to establish observed contembration

Commo realistica measurements (appliently to observed contamination for the soil exposure pathony);

-The grammap rediction exposure onte, as mesoured in sufcressessions per here (all/lin) using a servey instrument held 1 mater above the ground surface (or 1 mater every from an aboveground security, equals or exceeds 2 times the source), aquals or extends 2 time site-specific background genome radiotion exposure rate.

-Some portion of 2 increase areat be attributable to the site to establish observed contamination. The passes-emitting radionaciides do not have to be within 2 feet of the surface of the

For the three migration peditorage, if an observed release can be established for the esserved remote can be extended, as uppropriete), easign the pathway (or equilier or materials) on observed release factor value of 500 and proceed to section 7.2, if on shoured selecte cannot be established. ps an abserved release factor value of 0 of proceed to earlier 7.1.2.

For the sell expresse pathway, if absence intentiontion can be established, neelign th management can be established, neptyp the helthood of exposure factor for resident spaintion a value of SSO If there is an area of rackes a valu houved contamination in one or more entions listed in section \$.1; evaluate the Madhaud of exposure factor for nearby population on specified in section 5.2.1; and proceed to section 7.2. If observed nation curnet be established, do not

releate the sell exposure pathway. At altes containing mixed radioactive and her hazardous substances, evaluate shoured release for observed contraduction) septentely for redictorizides so described in this section and for other mandres substances or described in science 2 through 6.

rections 2 through s.

For the those migration pathways, if an illustroid subsect can be established based on illustroid subsections or other hazardens whotastos, or both, assign the political for spatiar or violationally an observed school intervalue of 350 and proceed to section 7.2. If an observed school cannot be established. If an observed release cannot be estable based on either radionacides or other strictions substances, easign att observed stone factor value of 0 and proceed to 111

Per the sail exposure pathway, if observed extensionates can be established based on their redismedides or other hexarders emar remanucators or other measures substances, or both, easign the likelihood of expense factor for resident population a value of 500 if there is an eron of observed contemination in one or more locations listed in section 5.1; evaluate the likelihood of in section 5.2; evenues we incurred of exposure factor for analyty population as opecified in section 5.2.1; and proceed to excite 7.2. If observed contamination council be established based as either rediconcildes er other hexardous substances, do not ate the sail expense pathway.

7.3.2 Patentive to release. For the three algoriton pathways, evaluate potential to allouse for sites containing radionacticles in the name manner as specified for siles containing other lezardous substances. Sage the evolution on the physical and chemical properties of the radiomedides, not on their level of radioactivity.

For sites containing mixed radioactive and other hazzedous substances, evaluate tratial to release considering redistractides and other bezardous substances together. Brahmte potential to release for each migration politivay as specified in sections 3.

4. or 6. as appropriate.
72. Wasse characteristics. For radioactive betances, evaluate the human toxicity factor, the ecosystem texicity factor, the

surface water persistance factor, and the hazardous waste questly factor as specified in the following sections. Evaluate all other waste characteristic factors as specified in no 2 through C.

Human tenicity. For radioucity, note, evaluate the human tenicity 7.2.1 House factor no specified below, not no specified in **= 2411**

Assign human tenicity factor values to nove radioanciidas available to the pathway print as descriptus que a

- peremeters for concertains as follows:

 Enshats sodienachiles only on the books
 of concenguality and assign off radiometides to wright of evidence category
- Assign a human traicity factor value from Table 7-2 to each antisonclide based on its aloge factor (also referred to an easeer acy factor).
 - -Per each radiomelide, use the higher of the slope factors for inhelation and
 - ingestion to sindyn the factor value.

 If only one slope factor is available for the radiomelide, use it to easign the tenicity factor value.
 - If so elope factor in available for the solicenciele, assign that radiosacide a texicity factor value of 0 and use other radiosacides for which a slope omelides for which a slope factor is available to evaluate the
- If all redienuclides available to a uricular pathway are easigned a human nicity factor value of 0 (that is, no slope actor is available for all the redienuclide use a default homen tendeity factor value of 8 as the human tenicity factor value for adjumnishes available to the pathway.

At this containing mined radioactive and other hazardour substances, evaluate the texticity factor separately for the radioactive and other hazardous substances and seeign texicity factor separately for the radioactive and other hazardan substances and satigate the a separate training factor value. This applies separation of whether the radioactive and other hazardan substances are physically exponented, combined chemically, or simply mixed tegether. Assign texicity factor values to the sationactides as specified above and to the other hazardans substances as specified in section 2.4.1.1.

At other containing mixed andisactive and other hazardans substances, if all redisacticles available to a particular polynosy one assigned a human texicity factor value of 1,000 for all those andisactive even if ancondencetive hexardous colorances available to the pathony one assigned human texicity factor value of 1,000 for all those andisactives even if ancondencetive hexardous outstances available to the pathony one assigned human

available to the pathony are conjused human toxicity factor values greater than 0. Similarly, if all neurodisective hexardoss selectances evailable to the pulsaray are notigeed a human texicity factor value of 0, use a default human texicity factor value of 100 for all those promotionative hazardous substances even if reflematides available to the political even is recommended over the political are assigned busine texicity factor values greater than 0.

7.2.2 Ecosystem texicity. For the surface water contrastantial threat foce sections 4.1.4

want (2.4), easign on ecosystem toxicity factor value to redissuciidts (alone or combined chemically or mixed with other hazardocs substances) using the same slope factors and

procedures specified for the human toxicity factor in section 7.2.1, except: use a default of 100, not 1,000, if all radiomedides eligible to be evaluated for ecosystem toxicity receive an ecceystem toxicity factor value of 0.

TABLE 7-2.—Toxicity Factor Values FOR RADIONUCLIDES

Caroar slope factor* (SF) (pC8**	Assigned
3×10 ⁻¹¹ ≤8F 3×10 ⁻¹¹ ≤8F<3×10 ⁻¹¹	10,000
SF<3×10 ⁻¹³ SF not available for the radionuclide	100

*Rectionuction slope factors are esti-veraged, individual Matima total exce-

At sites containing mixed radioactive and other hazardous substances, evaluate the ecosystem toxicity factor separately for the radioactive and other hazardous substances and assign each a separate ecosystem toxicity factor value. This applies regardless of whether the redipactive and other or watther the regularity and other hazardons substances are physically separated, combined chemically, or simply mixed together. Assign ecosystem toxicity factor values to the radionuclides as specified above and to the other hazardous substances as specified in sections 4.1.4.2.1.1 and 4.2.4.2.1.1 If all redionnclides evailable to a perticular pathway are easigned an ecosystem toxicity factor value of 0, use a default ecosystem toxicity factor value of 100 for all these radiomucides even if nonrelicactive hazardous substances noncemberry: hexactors sometimes available to the pathway are assigned ecosystem toxicity factor values greater than 0. Similarly, if all nonradioactive hazardons substances available to the pathway are ssigned an ecosystem toxicity factor value of 0, use a default ecosystem toxicity factor value of 200 for all these normadioactive hazardous substances even if radiounclides available to the pathway are assigned accorpited toxicity factor values greater than

7.2.3 Persistence. For radiomuclides evaluate the surface water persistance factor based solely on half-life; do not include sorption to sediments in the evaluation as is done for nouradioactive hazardon substances. Assign a persistence factor value from Table 4-10 (section 4.1.2.2.1.2) to each radiousclide based on half-life (t_{1/2}) calculated as follows:

$$t_{1/2} = \frac{1}{1+1}$$

where:

r=Radioactive half-life v = Volatilization half-life.

If the volatilization half-life cannot be estimated for a radionuclide from available data, delete it from the equation. Select the portion of Table 4-10 to use in assigning the persistence factor value as specified in section 4.1.2.2.1.2.

At sites containing mixed radioactive and other hazardous substances, evaluate the pensistence factor separately for each radioactive and for each nonradioactive hexardous substance, even if the available data indicate that they are combined chemically. Assign a persistence factor value to each radiomolide as specified in this section and to each nonradioactive hazardous substance as specified in section 4.1.2.2.1.2. When combined chemically, assign a single persistance factor value based on the higher of the two values easigned (individually) to the radioactive and

nonredicactive components.
7.2.4 Selection of substance potentially posing greatest hazard. For each migration pathway (threat, aquifer, or watershed, as appropriats), select the radioactive substance or nouradioactive hazardous substance that potentially poses the greatest hazard based on its toxicity factor value, combined with the applicable mobility, persistence, and/or bicaccumulation (or eccey) bioaccumulation) potential factor values.
Combine these factor values as specified in sections 2, 2, 4, and 8. For the soil exposure pathway, base the selection on the toxicity factor alone (see sections 2 and 5).
7.25 Hawardous wasts quantity. To

calculate the hexardous wasts quantity factor value for sites containing radioactive substances, evaluate source hazardous wasts quantity (see section 2.4.2.1) using only the following two measures in the following hierarchy (these measures are consistent with Tiers A and B for nonradioactive hazardous substances in sections 2.4.2.1.1 and 24212):

• Radiomolide constituent quantity (Tier

Radionaciide wastestream quantity (Tier

7.2.5.1 Source hazardous waste quantity for radionuclides. For each migration pathway, assign a source hazardous waste quantity value to each source having a containment factor value greater than 0 for the pathway being evaluated. For the soil exposure pathway, assign a source hazardous waste quantity value to each area of observed contamination, as applicable to the threat being evaluated. Allocate hazardous substances and hexardous wastastreams to specific sources (or areas of obs contamination) as specified in section 2.4.2.
7.2.5.1.1 Radionuclide constituent

quantity (Tier A). Evaluate radiomucitde constituent quantity for each source (or area of observed contamination) based on the activity content of the radionuclides allocated to the source (or area of observed contamination) as follows:

• Estimate the net activity content (in

curies) for the source (or area of observed contamination) based on:

-Manifests, or -Either of the following equations, as applicable:

$$N=9.1\times10^{-4}(V)$$
 $\sum_{i=1}^{n} AC_{i}$

N=Estimated net activity content (in curies) for the source (or area of observed contemination).

V=Total volume of material (in cubic yards) in a source (or area of observed contamination) containing radionnelidas

AC,-Activity concentration above the respective background concentration (in pCI/g) for each radiomolide i allocated to the source (or area of observed contamination).

n = Number of radionuclides allocated to the source (or area of observed contamination) above the respective background concentrations.

N=Estimated net activity content (in curies) for the source (or area of observed contamination).

V - Total volume of material (in gallons) in a source (or are observed contemination)
containing radionaclides.
AC_=Activity concentration above

the respective background concentration (in pCi/1) for each radiomedide i allocated to the source (or area of observed contamination).

n = Number of radionuclides allocated to the source [or area of observed contamination) above the respective background ... concentrations.

ate volume for the source (or volume for the area of observed contamination) based on records or necerrements.

For the soil exposure pathway, in estimating the volume for areas of observed contamination, do not include more than the first 2 feet of depth, except: for those types of areas of observed contamination listed in Tier C of Table 5-2 (section 5.1.2.7), include the entire depth, not just that within 2 feet of the surface.

 Convert from curies of radionuclides to equivalent pounds of nonradioactive hezardous substances by multiplying the activity estimate for the source (or area of observed contamination) by 1,000.

 Assign this resulting product as the radionuclide constituent quantity value for the source (or area of observed) contamination).

If the radionuclide constituent quantity for the source (or area of observed

contemination) is adequately districted that is, the total authory of all redissuctions in the source and releases from the source for in the area of elegannel estimated of the area of elegannel with measurely confidence, do not evaluate the redissuction vestanteum quantity measure is section 7.2.5.1.2. Instead, areity a value of 0 and proposed to portion 7.2.5.1.2. If the redissuction quantity of the source for one of elegantity determined, aprint the source for one of elegantity determined, aprint the source for one of elegantity seasons enterty based on esse of observed contembration) a value for rediscoulide constituent quantity based on the credible date and present to section 77517

72512 Redissorbly contesteen
quantity (The B) Believe indissorble
vertextream quantity for the course (or area
of observed quantum testion) based on the
activity content of militarnitish westerteen of the desired for the last of e for case of observed

istense or an extense or an extense of a cubic color or in galleput) of westerbosens or in galleput) of westerbosens and color

- course for ages of observed einstamination

 Divide the volume in orbit yards by

 6.65 for the volume in gallone by 110) to use per the volume in gallene by 110) to convert to the activity content expressed in turns of equivalent panels of nessedioactive beautique deleterane.

 • Assign the republing value on the nellenecities westesteem quantity value for the source (or case of observed contentsolien).
- 72813 Cal also of source become the soldenecking. 7.2.5.2.2 Calculation of source incomings weath quantity value for realization lides. Salast the higher of the values nesigned to the source for each of observed quantity and realization of the continue quantity and realization wastestown quantity. Assign this value as the source handons wester pe for the senses for cross of planting light. Do not reveal to the
- ed to all sources for comes of observation) for the justicesp being test come to the same integral course of the A. A. Sand on the A. A. Sand on the A. Sand on the A. Sand on the A. Sand on the w ten t has, andress or be value, coloct a hancolous weste queutly factor value for this pullmar their Table 2-0

inctor value for this pathway from Table 2-8 (acction 2.4.2.2).

For a signature pathway, if the redementity constituent quantity is adequately determined (see extrine 7.2.5.1.1) for all semants (or all partition of sources and schoose remaining other a removal action), assign the value from Table 2-4 or the houselons wants quantity factor value for the pathway. If the realismential constituent quantity is not adequately determined for one or now account for one or more remove account for one or more remove for one or more remove. er anne consens (er ann er men partient ef er enne consens (er ann er men partient ef econom er selvenen samelelig efter a removal action), conign a factor value en fellven; • If any taget for that migration pathony is subject to Lovel I er Lovel II encountacion less availant et the content of the

is subject to Love! I or Love! If entreatment (see excise 7.2), easign either the value from Table 3-0 or a value of 180, whichever is greater, as the homodeus works quantity factor value for that pathony.

 If none of the targets for that pathway is Aject to Level 1 or Level II concentrations. ion a factor val n es folgres:

- -If there has been no removal action, seeign other the value from Table 2-6 or a value of 32, whichever is greater, as the hazardous waste quantity factor in for that pathway.
- "There has been a removal ection:
 --Determine values from Table 2-6
 with and without consideration of
- with this consideration of the removal action.

 --If the value that would be assigned from Table 2-0 without consideration of the removal action from Table 2-6 without consideration of the removal action would be 100 or greater, assign other the value from Table 2-6 with consideration of the removal action or a value of 100, whichever in greater, as the hexardous weste quantity factor value for the
- polissey.

 If the value that would be assigned from Table 2-6 without even season of the removed action would be less then 199, easign a value of 10 as the hazardess waste quantity factor value for the

For the sell exposure pathway, if the distraction constituent quantity is dequately determined for all urons of served contemination, assign the value on Table 3-4 as the hazardous wests seen Table 3-6 or the horardous weate questly faster value. If the rediseaschile constituent questly in not adequately determined for one or more errors of observe contemination, assign either the value from Table 3-6 or a value of 16, whichever is greater, as the horardous weste questly featured.

7.253 Cade 7.25.3 Calculation of baserdour week mantly factor value for sites containing fund sedioactive and other baserdous substances. Per each course (or even of observed contention) and other learned and substances exhibited and other learned one who trace contenting to a substance contenting to a substance contenting two sources has not on substance quantity values—one based on substance to specified in sections 7.2.5.3 through 7.2.5.1.3 and the other based on the ctive becombene exhauseres es interestable in sections 2.4.2.1 through 2.4.2.1.5 (that is, datamine each value as if the other type of substance was not present). Sum the two values to determine a combined source

two values to determine a combined source leaserdone waste quantity value for the source (or area of abserved contemination). Do not result dis value to the measure integrate this combined source leaterdown was quantity value to calculate the hexandous weste quantity factor value for the positive; as specified in section 2.4.2.2, except: if cities the hexandous constituent quantity or the radiomedide constituent quantity, or both, are not adequately determined for one or more sources (or one or more portions of sources or releages someting after a superacres remaining after a rea ment or call action) or for one or more arose of chaptved contemination, as applicable, assign the value from Table 2-6 or the default value applicable for the potrony, whichever is greater, as the heasedone waste quantity factor value for the pathway.

7.3 Targets. For redisactive substances.
valuate the targets factor category as

specified in cention 2.5 and sections 3'th Q, except: establish Lovel I and Lovel II consentrations at compling locations as ing inco

specified in sections 7.9.1 and 7.9.2. For all pulmage (and threats), see the over an patterneys (and directly), use the same toget distance limits for alles containing malisactive substances or is specified in sections 3 through 6 for other containing naturalisactive languages substances. At Alles hetagas. At elles containing missed descrive and other basesdoes subs

reflective and other hassestess suscesses, include all sources (or asses of observed contemination) at the othe in identifying the applicable targets for the ppthrosp.

7.3.1 Level of contemination of a sampling location. Determine whether Level I or Level II concentrations apply at a sampling location (and thus to the associated targets)

6.5.1.

Select the beachmarks from section 7.3.2 applicable to the pathway (or threat) being evaluated.

 Compare the concentrations of radiomedicies in the complete (or comparable samples) to their benchmark concentrations termina to mar successors concessors for the pathway (or threat) as specified in section 7.12. Thest companable samples as specified in section 2.5.1.

• Determine which level applies based on

- Determine which level applies based on this companion.

 If sees of the sufficientials eligible to be evaluated for the simpling location have an applicable banchmark, assign Loved It to the actual contemination at that compling location for the patheony (or threat).

 In multing the companions, consider only those complets, and only those sufficientials in the complet, and only those sufficientials for an observed salence (or observed contemination) for the patheony, except: contomination) for the pathway, exce there employ hem equate human feed chain expains, may also be used for the human feed chain threat of the serious we polimny so specified in sections 4.1.3.3 and 4222
- 4.2.3.

 7.2. Comparison to hundrands. Use the following makin specific beindamatic. Use the following makin specific beindamatic. (exposeed in activity units, for assumple, pCi/l for water, pCi/log for eatl and for aspectic human food chain cognitions, and pCi/m³ for eity for making the comparisons for the indicated pathway for through:

 Micrimum Contemporary Lovels (MCLs)—ground water migration pathway and debiting water throat in surface water migration pathways.
- migration policety.

 Ususian Mili Tailings-Rediction Coutrol
 Act (UMTRCA) standards—self exposure
- pathway only.

 Screening concentration for concer-corresponding to that concentration that corresponds to the 10⁻⁶ individual concer risk corresponds to the M" institutes concur run for inhalation exposures (oir migration potenty) or for each exposures (grand water migration pathway; drinking water or human food chain threats in surface water migration pathway; and sell exposure pathway).
 - -For the well exponents pothway, include two expounting constantiations for concer-one for inpution of surface materials and one for extensi

Select the benchmark(s) applicable to the pathway (or threat) being evaluated, Compare the concentration of each licenciide from the sampling location to its schmark concentration(s) for that pathway sclide from the sum beachmark concentration(s) for max pureway, (or threat). Use only those samples and only those radionacides in the sample that meet the criteris for an observed release (or observed contamination) for the pathway, except tissue samples from aquatic human Conserved continuations for the pureway.

except: tiesue emples from equatic human food chain expeniums may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of any applicable radiomodide from any sample equals or exceeds its benchmark concentration, consider the benchmark concentration, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If more than one benchmark applies to the radionuclide, assign Level I if the radionuclide concentration equals or exceeds the lowest applicable benchmark concentration. In addition, for the soil exposure pathway, assign Level I concentrations at the sampling location if measured genma radiation exposure rates equal or exceed 2 times the background level face section 7.1.1). (see section 7.1.1).

If no radionuclide individually equals or

exceeds its benchmark concentration, but

more than one radionuclide either mosts the criteria for an observed release (or observed contamination) for the sample or is eligible to be evaluated for a tissue sample (see sections 4.1.3.3 and 4.2.3.3), calculate a value for index I for these radionuclides as specified in section 2.5.2. If I equals or exceeds 1, assign Level I to the sampling location. If I is less than 1, assign Level II.

At sites containing mixed radioactive and other hazardous substances, establish the level of contamination for each sampling location considering radioactive substances. more than one radionuclide either meets the

location considering radioactive substances and nonradioactive hazardous substances separately. Compare the concentration of each radiosucide and each nonradioactive hazardous substance from the sampling location to its respective benchmark iocation to its respective ventaments, concentration(s). Use only those semples and only those substances in the sample that meet the criteria for an observed release (or observed contamination) for the pathway except tiesus samples from aquatic haman food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of one or more applicable radiomiclides or other hazardous substances from any sample equals or exceeds its benchmark concentration, consider the

sampling location to be subject to Level I concentrations. If more than one benchmark applies to a radionacide or other hazardous authennoe, assign Level I if the concentration of the radionacide or other hazardous substance equals or exceeds its lower applicable benchmark concentration.

If no radionuclide or other hazardous substance individually exceed a benchmark concentration, but more than one radionnelide or other hazardous substance either meets the criteria for an observed release (or observed contamination) for the sample or is eligible to be evaluated for a tissue sample, calculate an index I for both types of substances as specified in section 2.5.2. Sum the index I values for the two types of substances. If the value, individually or combined, equals or exceeds 1, assign Level I to the sample location. If it is less than 1, calculate an index J for the nonradioactive hazardous substances as specified in section 2.5.2. If J equals or exceeds 1, assign Level I to the sampling location. If J is less than 1, assign Level II.

[FR Doc. 90-27195 Filed 12-13-90;845 am] BILLING CODE 9500-50-10